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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THORIUM

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At the present, there are two systems in which thorium can be used as a fuel material breeder. One is the use of metal or a thorium-bismuth alloy; the other, a thorium oxide slurry reactor. Both procedures are being investigated by the AEC and private industry. It is believed that at the assumed burn-up rate of thorium oxide (one pound of ThO_2 for six megawatt hours of electrical energy) the thorium-rare earth industry is probably capable of handling domestic demands without excessive expansion. Thorium looks good as a reactor fuel for private industry because it is much more plentiful and economical than uranium.

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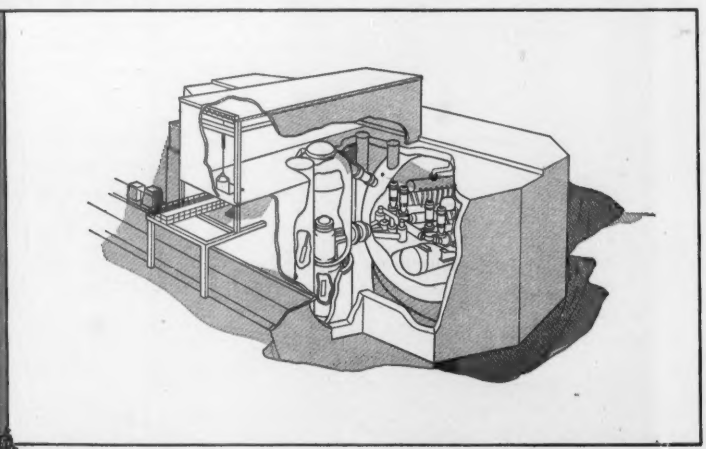

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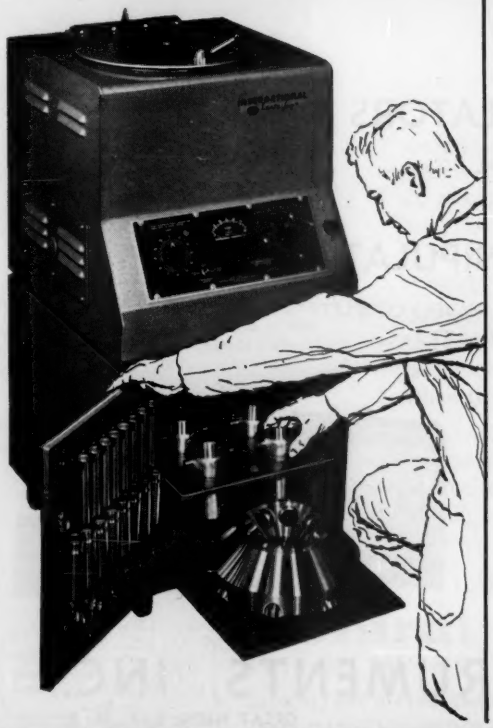

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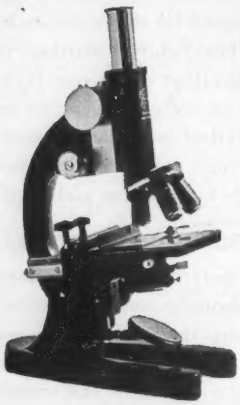

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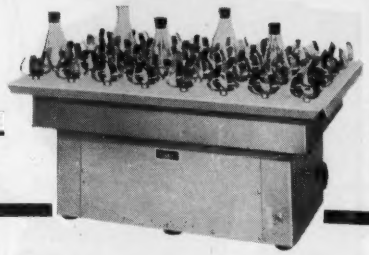

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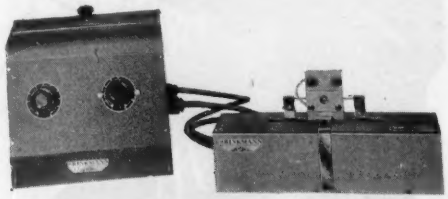

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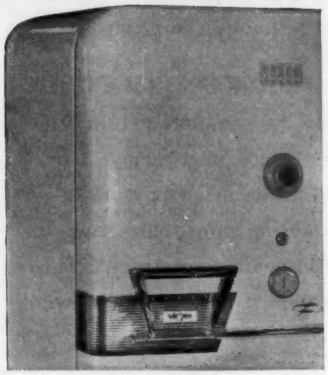

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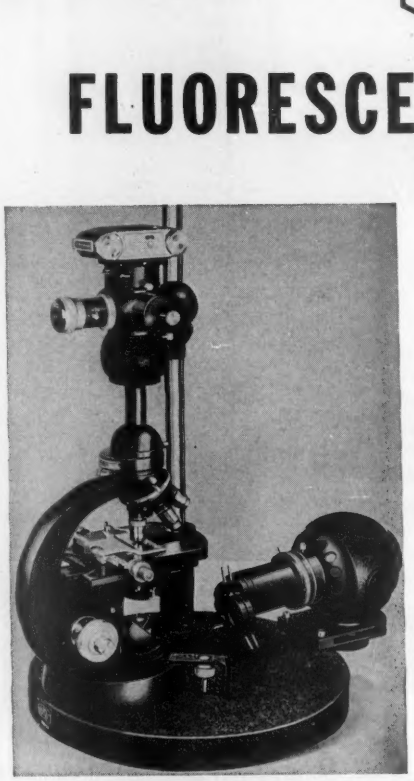

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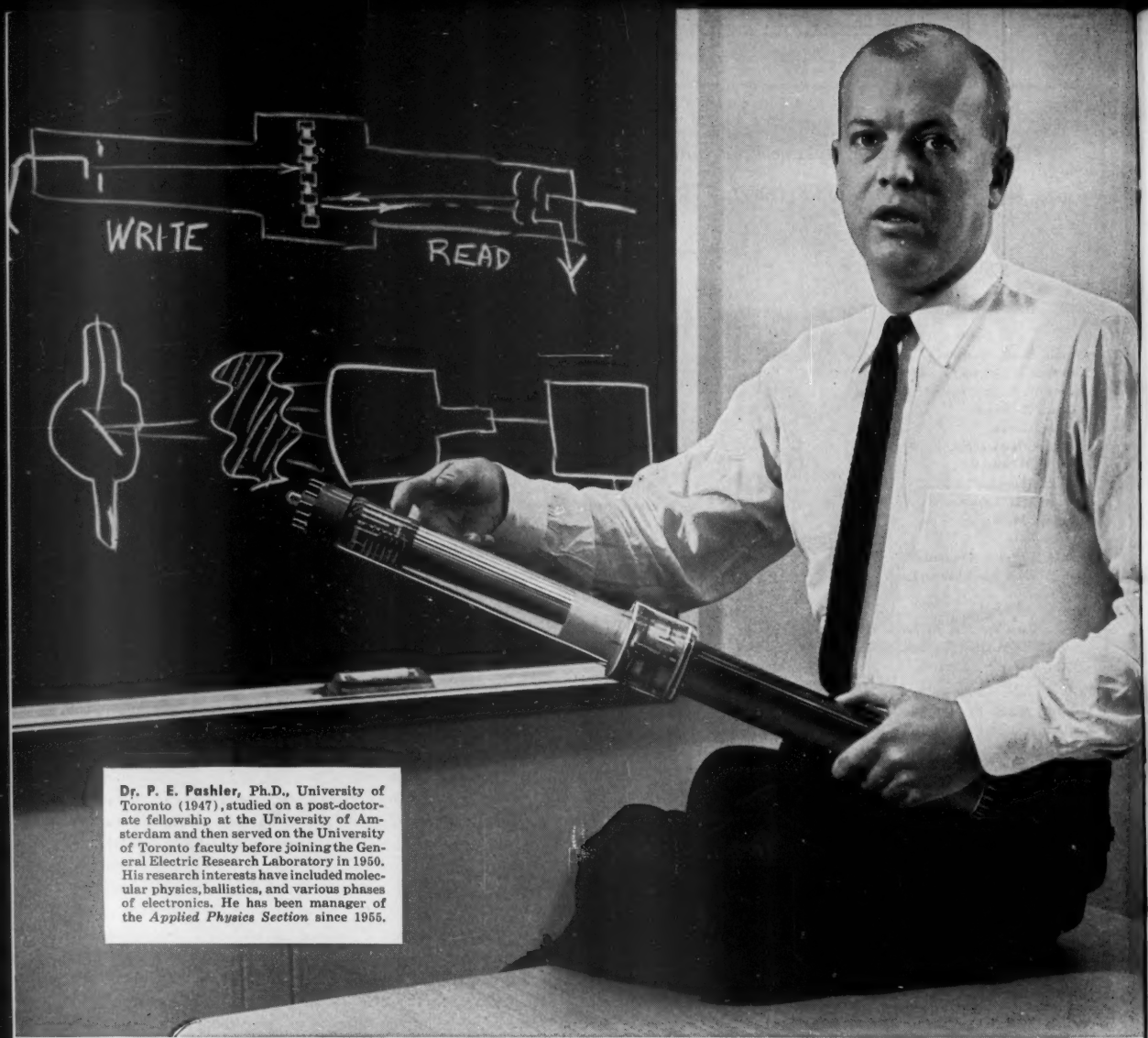
Science on TV

We do not know how much confusion about science is generated in the minds of the television viewers by the ubiquitous pitchman in the white coat, full of "scientific proofs" and oily admonitions. He relies on gadgets and the use of "controls," often irrelevant. He may triumphantly demonstrate the efficacy of a deodorant by passing a presumably noxious vapor through a "smellometer" before and after treatment. Or he may demonstrate the well-known capacity of an acid to eat a hole in a pocket handkerchief and show that addition of such-and-such a product, conveniently available in the form of pills, can neutralize the acid. To anyone who recalls a bit of physiology this is puzzling, for he knows that the stomach contents are normally acid and that the digestive juices operate only in an acid medium. The moral is difficult to draw. It would seem to be that somehow acid is a bad thing to have in your stomach or, possibly, that if you want to eat pocket handkerchiefs, you had better not take such-and-such at the same time.

But it is scarcely fair to judge television by its commercials alone. Some good scientific programs have been produced. To select only one example, the California Academy of Sciences has been producing a weekly television show called "Science in Action" for more than six years. This production has been highly acceptable to scientists as well as to the general public. Perhaps the essential element in its success can be expressed in a single word: integrity. The show presents scientists themselves, has scripts approved by the scientists who appear, and is straightforward and honest in presentation. There is no sensationalism, no talking down to the audience, and no glossing over of unsolved problems. In short, the picture of scientists and their work is realistically, truthfully, and entertainingly presented.

But this program has not reached a nation-wide audience. Accordingly, we are especially interested in a new scientific television series that is to begin on 19 November at 10 P.M. E.S.T. over the network of the Columbia Broadcasting System [*Science* **124**, 929 (9 Nov. 1956)]. This will be an hour show in color. The aim of the series is to "give the public a better understanding of what science is and how scientists go about their work." The producers "take the view that science is a challenge that engages both the mind and the imagination" and that the series is designed to "present authentic scientific information in terms that will interest and entertain a mass popular audience." The fact that a distinguished group of scientists have acted as advisers to the producers should assure authenticity of the scientific events depicted, but we must wait for opening night to judge whether or not the producers and director have found a way to "interest and entertain a mass popular audience" without distorting the aims and spirit of science.

The aims of the series are laudable. It is important that a better public understanding of science be achieved. If such understanding is achieved, one of the consequences, and not perhaps the least of them, will be that viewers may no longer be impressed by the pitchman in the white coat. We wish the project every success.—G. DUS.



Dr. P. E. Pashler, Ph.D., University of Toronto (1947), studied on a post-doctorate fellowship at the University of Amsterdam and then served on the University of Toronto faculty before joining the General Electric Research Laboratory in 1950. His research interests have included molecular physics, ballistics, and various phases of electronics. He has been manager of the *Applied Physics Section* since 1955.

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Dr. P. E. Pashler of General Electric studies the basic phenomena associated with electronic devices

Hearing, speaking, and seeing are among the "human" functions that electronic equipment has been performing since the birth of radio and television. Newer electronic systems demand devices that also can read, write, remember, and calculate.

Dr. P. E. Pashler and a group of his associates at the General Electric Research Laboratory are seeking a better understanding of the basic principles of electronic materials and devices through studies of such fundamental phenomena as secondary electron emission and noise in electron tubes.

Among the recent accomplishments of Dr. Pashler's *Applied Physics Section* are the improvement of photoconductors to give camera tubes the special sensitivity and quick response required for x-ray television, and the development of an information storage tube with a tiny memory cell only an inch square that will remember nearly a million "bits" of information.

As we see it, providing scientists with freedom and incentive to extend the frontiers of knowledge is fundamental to the creation of better products, better jobs, and more opportunities for human satisfactions.

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16 November 1956, Volume 124, Number 3229 SCIENCE

How Shall We Pay for Research and Education?

Paul E. Klopsteg

Population trends in the United States during the past two decades, along with the changing public attitude toward higher education and research, have posed a predicament for our colleges and universities. The approaching tidal wave of increasing college enrollments—a wave that has already engulfed our lower schools and is lapping the shores of higher education—is giving administrators and governing bodies apprehension and anxiety. The predicament is the inadequacy of operating funds to keep abreast of the rapidly growing needs of the institutions (*1*).

The report of the Committee on Institutional Research (*2*) of the American Council on Education states as fundamental principles that "all accredited institutions of higher learning subscribe with varying emphases to three primary and essential aims: (*a*) the *extension* of the boundaries of knowledge; (*b*) the *conservation* of knowledge already acquired; and (*c*) the *diffusion* of knowledge through teaching, publication and other accepted methods of dissemination." It states further that "institutions of higher education are the principal instrumentality through which new knowledge is created by research scholars, existing knowledge is preserved and propagated through libraries and the minds of faculty members and students, and knowledge is disseminated through teaching and publications. In order that they may fulfill their primary and essential functions, institutions of higher learning require the utmost freedom in both their administrative and academic activities."

That these principles are truly fundamental in our society is beyond argument. The preservation of the essential freedom of research and education must be assured. Is it, in fact, assured in the future, or is freedom threatened? If we consider seriously the aforementioned predicament, there is no escape from the view that freedom of research and education, in both its administrative and intellectual aspects, is indeed threatened.

Government agencies are supplying, in growing amounts, funds for scholarly research but not to support the teaching function and other primary and essential activities in higher education. If the rapidly growing demands on institutions should bring about increasingly unbalanced budgets, substantial federal support of all education would appear inevitable. Although present support by government of research activities seems to have no concomitant control or intrusion, these are appearing in subtle, though not insidious, ways. They develop almost spontaneously, without plan or intent, simply because the expenditure of government funds calls for safeguards against improper disbursement and for checks to insure proper use. The exercise of such authority of guardianship of funds almost invariably becomes bureaucratic and can easily develop sinister aspects. If federal aid to education, as well as to research, were to increase by large sums, we could not afford to remain complacent about the likelihood of increasing government control.

Thus, although federal subsidy appears to be a way out of one predicament, it immediately leads into another. Under the irresistible pressures that come with increasing demands on educational facilities, we are not only accepting but actively seeking more government money, notwithstanding the probability that this carries with it increasing government intrusion and eventual control.

The situation, though serious, is not yet hopeless. A remedy is possible which keeps complete authority of management and direction in the hands of the governing and administrative heads of our schools and colleges, where it belongs, and does not permit it to pass under the heavy hand of some federal agency, where it might easily become lodged.

Dilemma of Colleges and Universities

From its very beginnings, our nation attached great importance to the education of its citizenry. Public policy called for schools, locally founded, supported, and controlled. Colleges in growing numbers were established. Some were privately started and run by religious organizations, some by secular groups, others by municipalities and states. Attempts were made to establish a national university, but the idea of federal support never took root. Indeed, strong sentiment prevails in the Congress, reflecting public sentiment, against federal subsidies for education, especially at the higher levels. Unless some better way is found soon, however, federal money for education may, by default, become the pattern for an attempted remedy for the present and impending difficulties.

Faced with the increasing pressure for more admissions, private institutions may and do take the position that they can accept only so many students, that they are under no obligation to take more, and that they will raise admission standards to limit enrollment. No one expects a college to carry a larger load than its resources allow. It may be suggested, however, that, as an institution organized to serve a public need, it may soon have to find means for expanding its capacity. As private institutions limit their admissions, the burdens are increased on those supported by taxes. Of the latter, many are under pressure and some are under compulsion to accept all qualified comers, the qualification being a high-school diploma. How can the schools, public and private, under increasing heavy demands, solve the dilemma? All of them should be expanding their facilities now to take care of future student population, which is expected to double in the next 15 years, and probably sooner.

Dr. Klopsteg is associate director of the National Science Foundation. This is the second of two articles on related subjects. The first article appeared in last week's issue of *Science*.

By minor artifices we may defer, but cannot avoid, facing the problem: how shall we finance research and education? These are the solid foundation of the nation's future, and funds for their support must be adequate to provide superior opportunities for gifted students and able scientists. Greater knowledge and fuller understanding in all fields of learning must be the goal. *No equal expenditure of money can bring greater returns for the public benefit.* In no other way can we achieve the freedom that comes from knowing the truth. In no other way can we as a nation hold our own on this overpopulated planet. As we face the problem squarely, we find only one solution: assurance that a sufficient part of our vast national income will flow normally and effectively into education, to meet its financial needs as they arise.

In trying to bring this about, should we take the "easy" way? During the past couple of decades, a father complex seems to have come upon many of our citizens, causing them to look to Washington as the ever-present help in time of trouble, especially when money appears to be the remedy. Many people seem to think that money from the Federal Government does not cost anybody anything. The easy way then would be to look to the government to make annual grants to cover all operating deficits in education, under a formula by which funds would be doled out to all institutions, public and private.

To do this by statute would require a highly sophisticated law under which an attempt might be made to secure fair and just distribution, with effective safeguards against abuse. These are almost unattainable specifications. If they were attainable, and if easy money were meted out year after year, the institutions would lean more and more on federal support and depend less and less on their own efforts and resources. The disbursing agency would have the annual task of accurately and objectively budgeting the needs, beginning 2 years in advance; of gaining approval by the Bureau of the Budget; of getting the budgeted amount through the Congressional mill to an appropriation, with all the political implications of the process; and, finally, of disbursing the funds thus provided.

It is not a reassuring picture. A vast organization would be needed by the dispensing agency. It could easily become one of the greatest empire-building bureaucracies that the country has known. It would have to be vividly mindful of the fact that every college and university is in a Congressional district. Could the institution in such circumstances escape governmental intrusion in its affairs, or avoid a measure of eventual control from Washington? If we treasure our heritage of freedom in thinking, in learning, in teaching, we cannot take the risk of traveling this way.

Private Support Is Needed

What, then, is the alternative? There is only one. *The money needed to keep our colleges and universities solvent must be private, not public, money; and it must come from a great number and diversity of sources to assure complete independence from outside influence or control.*

The efforts that are being made by friends of education to encourage and develop increased giving by corporations are commendable and should continue. Such gifts, though significant, cannot be more than a partial solution. Sentiment already exists against too large a fraction of the supporting funds being derived from business and industrial corporate sources. Even if it were feasible to get all needed support from them, strong antipathy against doing so would surely develop.

Desirable and helpful though they may be, gifts from business or industrial corporations are neither easy to come by nor easy to keep coming year after year. Boards of directors are trustees for the owners. They must be circumspect in either spending or giving away their stockholders' money. When the economic situation becomes unfavorable, prior actions are easily rescinded. Moreover, a large part of corporate aid is special-purpose money for specific projects or activities, to assure easy justification to stockholders. Although some special-purpose money can be well used, institutions would be hamstrung if the major part were of this kind. Keeping institutions in good balance in all fields of learning requires funds that, for the most part, are uncommitted.

In these considerations, then, there is left only one source for the kind and quantity of money needed. It is the individual whose income is enough to make him a potential donor. If he makes a federal income tax return, he is in this class. Of his kind there are many millions. He is a major source of the federal revenue. As a donor of gifts for the general welfare, especially education, he has not collectively distinguished himself. There are, to be sure, outstanding exceptions among individuals in all income classes, and their generosity is most heartening. But at the very best, the total of their gifts cannot now come near to meeting all needs. However generous, they cannot fairly be expected to carry the whole burden.

Although it may seem that our individual generosity is not notable, we are in fact a nation of givers, and we are almost unique in this respect. Were we not collectively generous, our government could not, year after year, maintain its program of foreign aid for nonmilitary purposes. But we could not be collectively generous unless we were individually so. If, then, the present total of gifts for public causes is relatively low, the reason is to be found not in the individual's unwillingness but rather in his inability to be generous.

Table 1. A table drawn to assist in explaining and illustrating how a simple revision of the income tax laws would operate to make the cost of giving commensurate with the giver's income.

I Group No.	II Highest surtax rate (%)	III "Gift surtax" (%)	IV Present cost of gift dollar (ct)
1	No surtax	2	80
2	20 to 31	3	80 to 69
3	32 to 41	4	68 to 59
4	42 to 51	5	58 to 49
5	52 to 61	6	48 to 39
6	62 to 71	7	38 to 29
7	72 to 81	8	28 to 19
8	82 to 91	9	18 to 9

Income Taxes and Individual Giving

Notwithstanding the apparent unqualified approval by government of the taxpayer's charitable inclinations, expressed by its permission to him to deduct up to 30 percent of his adjusted gross income for legal charities, he failed in 1954 by about $20 million to take advantage of this exemption. Deductibility of charitable gifts must, therefore, be regarded as a gesture, not empty but unrealistic. Under this seemingly generous provision the government exposes itself to possible loss of substantial revenue—namely, the taxes on the billions that the taxpayer might make as deductible gifts. Why has this provision failed so utterly to stir to vigorous action the generosity of individuals toward making gifts to worthy public causes?

Such gifts, approved by government, are called a *legal charity*. They are the "charitable contribution" now deductible from adjusted gross income in the computation of federal income tax. The term *legal charity* was superbly well defined in 1867 by Horace Gray, associate justice of the Massachusetts Supreme Court and later a justice of the United States Supreme Court: "A charity, in the legal sense, may be more fully defined as a gift, to be applied consistently with existing laws, for the benefit of an indefinite

number of persons, either by bringing their minds or hearts under the influence of education or religion, by relieving their bodies from disease, suffering or constraint, by assisting them to establish themselves in life, or by erecting or maintaining public buildings or works, *or by otherwise lessening the burdens of government.*" (Italics are mine.) In view of the great number of government-approved legal charities, why have individuals declined by so wide a margin to make deductible gifts?

The answer is found in the glaring inconsistency between the government policy of approving gifts "to lessen the burdens of government" and its income tax laws. The curious if not startling fact is that *the tax laws operate to increase greatly the ability to give of those whose income makes them most able to give and to diminish drastically the ability to give of those whose income already renders that ability low.* The cost of giving for persons with a maximum surtax rate of 20 percent is almost 9 times that for those at the 91-percent maximum.

How does the disparity in the cost of the gift dollar arise? Consider one of the dollars given by the person whose highest surtax rate is 91 percent. It is tax-free. But if he had not given it, government would have taken 91 cents, leaving him 9 cents. Thus the dollar he gave cost him 9 cents. By like process, we find that the cost of the dollar for one whose highest rate is 20 percent becomes 80 cents.

Such disparity in cost of giving between those of low and high incomes, respectively, does not harmonize with governmental approval of giving as now expressed in the income tax laws. *The zooming rise in cost of the gift dollar, with decreasing amounts of adjusted gross income, is a powerful deterrent, not an incentive, to liberality* (see Fig. 1*A*). This has undoubtedly been a major cause of the restraint by the individual upon his generous inclinations. To the person with income in the thousands or low tens of thousands, there is a double deterrent to giving. The first is that, after living expenses and other normal obligations have been met out of the year's income, the surplus remaining for savings and gifts is small; thus the intrinsic value of his surplus dollar is large—relatively much greater than it is for his counterpart with large income. The second deterrent is the amount that the gift dollar costs him. The effect is to put restraint on his generous impulses and to make him take the position that the government had better use the taxes he pays to finance the public causes that seek his donations.

The inequity of the situation as it affects the individual who may wish to support worthy enterprises is clear, and its remedy is clear. *The cost of the gift dollar to the person with low income should be no greater, and preferably less, than its cost to the wealthy donor.* The cost of giving should be commensurate with income. Giving should be possible for all taxpayers. With a well-designed plan for establishing the obviously fair principle that has been stated, there is little question but that greatly increased and probably adequate funds for all worthy public causes would be forthcoming. They would come from a substantial fraction of the 40 million people who now pay income tax on the basis of Form 1040, in accordance with their own choices and decisions. Such widely distributed giving is in the pattern of our tradition, an expression of the democratic process. It has been the mainstay of many of our necessary and valuable causes. With growing population, their increasing support becomes imperative. Education and research present the most immediate and most critical need.

Recommended Revision in Tax Laws

To remedy the disparity in cost of gift dollars under the income tax laws involves relatively simple mechanics. Several methods can be devised by which a positive incentive to giving would replace the existing negative one, and which would end the incongruity between the tax laws and the government's approval of giving. The simplest of those which I have considered is illustrated in Table 1 and Fig. 1*B*.

The plan contemplates classifying all who pay an income tax, other than those

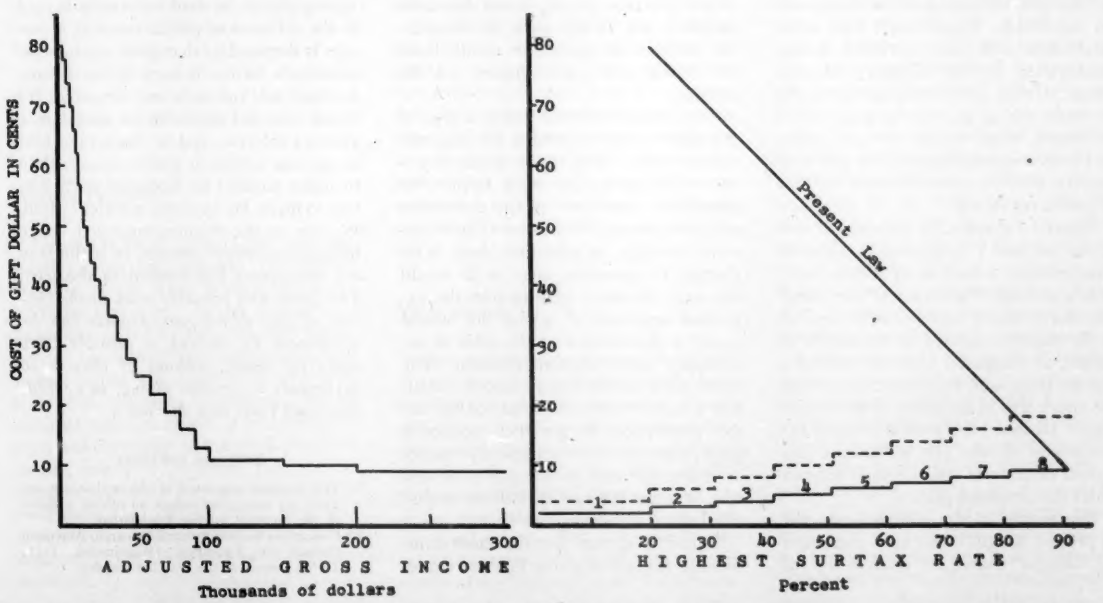

Fig. 1. (*A*, left) Cost of gift dollar in relation to adjusted gross income. (Data from Internal Revenue instruction pamphlet for 1954, p. 14, schedule I.) (*B*, right) Solid step-graph shows proposed gift surtax in Table 1, column III. Dotted step-graph shows same but with rates doubled. Numbers on steps indicate groups, column 1.

who use the standard deduction, in eight groups, as shown in column I. (For those with incomes under $5000 who do not itemize deductions a modification of the plan is indicated.) Column II provides the basis, in terms of highest surtax rates used, for the classification. Column III is an illustrative set of percentages, one for each group, to represent a "gift surtax." Column IV shows the present cost of the gift dollar for each group.

Under this plan the income tax would be computed as it is now except that gifts would not be deducted from adjusted gross income before making the computation. The resulting highest surtax rate would establish the individual's group. His total donations, up to some limit, such as percentage of adjusted gross income, would be a tax credit, to reduce the computed gross tax by the permissible amount. Finally, the "gift surtax," column III, would be added. This would be the cost of the allowable gift in each of the respective groups.

As an example, suppose that the taxpayer is in group 5, that his computed gross tax is $10,000, and that his gifts total $2000. The gift credit, assumed to be within the permissible limit, reduces the tax to $8000, to which is added the gift surtax of 6 percent of $2000, making the final tax $8120. His gift dollar has cost him 6 cents, as compared with the present 9-cent cost at the 91-percent surtax rate.

The table and example are intended to be illustrative only. Thorough analysis is needed to determine appropriate rates for the gift surtaxes and the limitations on tax credits. These would have to be established with some flexibility in administration by the Treasury Department, so that small adjustments could be made during an experimental period of several years. Limits on tax credits and percentages established for gift costs would constitute valves by which the flow of gifts is regulated.

Figure 1*A* graphically presents the cost of the gift dollar in relation to adjusted gross income, according to present laws. It is a striking illustration of the excessive cost of giving for those with incomes in the smaller number of thousands of dollars, as compared with the moderate cost for those with incomes ranging from the upper tens to hundreds of thousands. Figure 1*B* shows the present relation between cost of the gift dollar and the highest surtax rate and the same relation under the proposed plan.

The essence of the scheme is simple. At present the gift dollar costs the donor the amount shown in column IV of Table 1. Under the proposed plan it would cost him, in cents, the amounts shown as percentages in column III. This makes giving no less attractive than under present laws for the wealthy, but makes it much more feasible and hence more attractive for those with moderate or small incomes. The change in laws would give the many millions in, say, the lower four groups an opportunity that they are now virtually denied: to participate effectively in truly democratic support of education and other public enterprises.

That there will be strong objections to the plan may be surmised, and some of them are easy to anticipate. One comprehensive answer to any objection is that for education there is no possible third choice; either the mounting deficits will be financed by government, or they will be met privately. If the plan here proposed is not the answer, we face the challenge of devising a better answer. A decision must be made and action taken promptly, because the situation is critical and becoming worse.

There will be great reluctance in some quarters to do anything that might reduce gross public revenue. But we must look at the *net* decrease, and, whatever it may be, it will be a low price indeed for the benefits to be derived. Here is a plan that would avoid not only the cost but the adverse political aspects of the channeling of funds through government. The gift dollar would reach its destination with its value intact. If it is forced through government channels, its value is reduced by one-half or more. Since in either case the money comes from the taxpayer, the saving made in eliminating government operations would leave his income after taxes higher, on the average.

One objection raised is that a plan of this kind would be putting the expenditure of public funds in the hands of private individuals. The reply is that the possibility exists now, in the permissive deduction up to 30 percent of gross income for gifts. In principle, there is no change; in operation there is. It would not only introduce realism into the expressed approval of giving but would assure a distribution of the gifts in accordance with popular decision. The many millions of donors would constitute a valid statistical sample of the entire population. Hence their collective good judgment could be implicity trusted, as experience and history prove. At any rate, it is not inferior in wisdom to that of a central disbursing agency.

Should it appear that the more emotionally motivated giving to some causes provided funds disproportionate to the needs, the controls built into the plan could be operated selectively. Obviously any plan must be wisely administered. Amendments to the income tax laws will always embody safeguards against abuses; the Congress will see to that.

In its most important positive aspects, once the details of the plan were wisely developed and set in operation, it would solve the deeply rooted problems of education for the long term. As population and the need for more funds for education grow, the flow of support would similarly increase. It would help to solve the immediate problems of the school districts, the colleges, and the universities. There would be adequate funds for research on disease and public health and for the support of the basic research which is one of the primary responsibilities of the institution of higher education. Community funds would benefit immediately, as would the Red Cross. Religious charities would become better able to carry on their humanitarian efforts among the underprivileged, the ill, and the disabled.

Apart from the substantial quick and long-term relief that would be provided the elementary and secondary schools, and the easement that the plan would offer higher education and other qualified causes, there is an aspect of even greater significance. Where the gift dollar goes, the giver's interest follows. His interest continues as he sees the dollar to its destination and observes the intended beneficial results. On the other hand, if the money thus to be used eventually is paid to the collector of public revenue, a curtain is dropped at that point against the taxpayer's further interest in his dollars, for their destination is now obscured. No better way has appeared to stimulate a citizen's interest, and to encourage him to become active in public causes, than to make possible his financial participation in them. He becomes a better citizen. We can, in the manner suggested, make millions of better citizens. It is the way our democracy has worked in the past. *This great and valuable asset to the success of our democratic process can be recaptured by making it possible once again for many millions of citizens to participate in private giving, in accordance with their own decisions.*

References and Notes

1. The opinions expressed in this article are entirely my own; they reflect no official position of the National Science Foundation.
2. Committee on Institutional Research, American Council on Education (Washington, D.C., 1954). Known as the Hancher Report.

Electron Microscopy: Cytology of Cell Fractions

Alex B. Novikoff

Since the inception of the technique of differential centrifugation, biochemists have been concerned with the cytologic characterization of the sedimented fractions. In homogenates of liver, the organ generally chosen for such studies, they were able to identify unbroken cells, erythrocytes, nuclei, and mitochondria with the usual light microscope. The phase-contrast microscope made analyses of these structures considerably more reliable, and it made possible the detection of microsomes (*1*) and the identification of structures such as bile canaliculi (*2*). Electron microscopy of thin sections now brings within reach virtually complete cytologic characterization of all particulate fractions.

It is the purpose of this article to indicate how in a short time, beginning with the studies of Palade (*3*) and Palade and Siekevitz (*4*), the electron microscope has contributed significantly to the study of cell fractions. Our work (*5–8*), like that of others which is to be discussed, has dealt thus far with normal rat liver. Figure 1 is a diagram of the parenchymatous cell of this organ, in which are shown the structures revealed by electron-microscope studies to which I shall refer.

Nuclear Fraction

Of all the fractions obtained from the usual sucrose homogenates, the nuclear fraction is the most contaminated. In addition to nuclei, variable numbers of unbroken cells, erythrocytes, cell membranes (including bile canaliculi), and mitochondria can readily be seen with the phase-contrast microscope. Phase-contrast microscopy also gives some indication of extraction of materials from the nuclei, particularly when the nuclear fraction is washed. Surrounding each free nucleus is an irregular clear zone into which cytoplasmic particles do not move, suggesting the presence of a gel-like material.

Thus far we have obtained the best electron micrographs of this fraction when it was isolated from 7.3-percent polyvinylpyrollidone-0.25*M* sucrose homogenates (*8*). Following fixation in 7.3-percent polyvinylpyrollidone, 0.25*M* sucrose, and 2-percent osmium tetroxide at *p*H 7.0 (*6*), the nuclei appear like those of tissue sections. The nucleoli show prominently (*9–11*). The nuclear membrane, still clearly double, shows regularly spaced gaps distributed like the nuclear "pores" described in tissue sections (*11–14;* but see *15, 16*). The manipulative procedures appear to have enlarged the "pores," and in many of them a finely granular material is seen which is also present within and just outside the nucleus. This probably corresponds to the gel-like material seen around the nuclei with phase-contrast microscopy; it may contain the protein which Pollister and Leuchtenberger (*17*) showed to be lost from nuclei during their isolation from aqueous media.

Among the non-nuclear components of the fraction, one can readily discern in the thin sections the mitochondria and microsomes with their typical fine structure described in subsequent paragraphs. Also present are many small membranous structures that require further study. Some seem to be the microvilli first revealed by electron microscopy inside the bile canaliculi in tissue sections (*10, 11, 18*).

Mitochondria

Mitochondria were isolated from liver for the first time by Bensley and Hoerr in 1934 (*19*). Shortly thereafter, Claude (*20–22*) reported the separation of submicroscopic granules as well as "large granules." It was Claude's work (*20–23*) that made differential centrifugation one of the most popular techniques of modern biochemistry. Yet, for reasons discussed by Hoerr (*24*), it left the cytologic nature of the "large granule" fraction unclarified. In 1948 Hogeboom, Schneider, and Palade (*25*) found that the granules of the fraction were stained by Janus green B. They were also able to show that, when they were isolated from hypertonic sucrose homogenates, these granules were often rod-shaped, as they are in intact cells. Since that time, the fraction has been referred to as "mitochondrial." The notable success of biochemists in demonstrating that the mitochondrial fraction carried on oxidative phosphorylation and possessed other important enzymic properties relegated to the background the problems of alteration of the granules during isolation and the contamination of the fraction by other cytoplasmic constituents.

The different shapes and sizes of mitochondria isolated from different media could be determined by light microscopy. With phase-contrast microscopy, the alteration of mitochondria could be followed—for example, when the hypertonic sucrose rods swelled into large spheres containing crescent-shaped areas at one pole. With the electron microscope it is possible to judge the loss of material from their interiors and the changes in outer and inner membranes (*26–28*). Witter, Watson, and Cottone (*29*) were the first to publish electron micrographs of the alteration of fine structure of mitochondria isolated from isotonic and hypertonic sucrose (*30*); from their studies, these authors suggested 0.44*M* sucrose that has been brought to *p*H 6.2 with citrate as a medium from which to isolate the mitochondria. On the basis of similar studies, I have suggested (*5, 6, 8*) 7.3-percent polyvinylpyrollidone plus 0.25*M* sucrose at *p*H 7.6 to 7.8.

Electron microscopy also makes possible unequivocal decisions concerning the contamination of mitochondrial fractions. For example, the difference in opinion between us (*1*) and Laird *et al.* (*31*) was readily resolved by studying thin sections of purified "fluffy layer" (*5, 6*).

By evaluating the purity of the mitochondrial fractions and the state of mitochondrial preservation, electron microscopy can go far toward resolving the question of whether in liver the mitochondria are biochemically heterogeneous. I have recently (*6*) reviewed the literature and have expressed the opinion that the biochemical data are as yet inadequate to establish such heterogeneity.

I have noted (*6*) that rat-liver homogenates contain many small mitochondria, the average dimensions of which, in the sections, are 270 and 610 millimicrons. These appear to have a greater number of electron-dense granules, particularly in relation to size, than the other mitochondria. If, as Weiss (*32*) suggests, these granules bind potassium in an osmotically inactive form, their greater number may be related to an apparently greater resistance of these mitochondria to osmotic swelling during homogenization and washing in hypertonic sucrose (*6*). Chemical analyses of these small mito-

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chondria would be highly desirable, but we have been unable as yet to prepare them free of microsomes.

It is interesting to consider whether these small mitochondria of liver correspond to the "ultrachondrioma" described in leucocytes and other cells by Oberling and coworkers (*33, 34*). On the basis of their shape, osmophilia, and polymorphism, and on the basis of the existence of transitional forms, these authors consider the "ultrachondrioma" elements to be small mitochondria. It is to be expected that thin sections will be studied to determine whether their fine structure is that of mitochondria. The width of most "ultrachondrioma" elements is about 150 millimicrons or less. The mean width of the small liver mitochondria is considerably greater (270 millimicrons), but about 20 percent are only 160 to 180 millimicrons wide. In evaluating the difference between the two types of particle, we may have to consider not only the different cells from which they are derived but also the fact that the cells showing "ultrachondrioma" grew flattened on Formvar films and were studied as whole mounts.

Microsomes

Only with electron microscopy of thin sections is it possible to relate the microsomes to cytologic entities with any degree of confidence. Although much remains to be done before we can describe the fine structure of the entire microsome fraction, even of normal liver, already it is possible, *for this tissue*, to attach cytologic meaning to a term which, from the time Claude (*21*) adopted it for the "small granules," has remained simply an operational name for the granules that remain in suspension after the "large granules" have been sedimented. In adopting the noncommital term for the fraction, Claude (*22*) pointed out that "a more descriptive term may be indicated when the nature and function of the submicroscopic substance is better understood."

Studies of the microsome fraction of rat liver by Palade and Siekevitz (*4*) and later ones by myself and others (*35*) show the major constituent of the fraction to be the membranes on which are found the small dense particles seen by Weiss (*36*) and described in fine detail by Palade (*37*). When the microsomes are isolated in isotonic sucrose and fixed in isotonic sucrose and osmium tetroxide, the membranes appear as tiny granule-studded sacs. However, when they are isolated in hypertonic sucrose or in polyvinylpyrollidone-sucrose and fixed in the same media plus osmium tetroxide, the membranes are flattened and virtually identical, except for length, with the basophilic material that is seen in liver sections (*6, 8, 10, 11, 27, 38*).

Electron microscopists have divided sharply on the question of whether to speak of this basophilic material as "ergastoplasm" (*36, 38, 39*) or "endoplasmic reticulum" (*37, 40–42*). Those who preferred the latter name pointed to

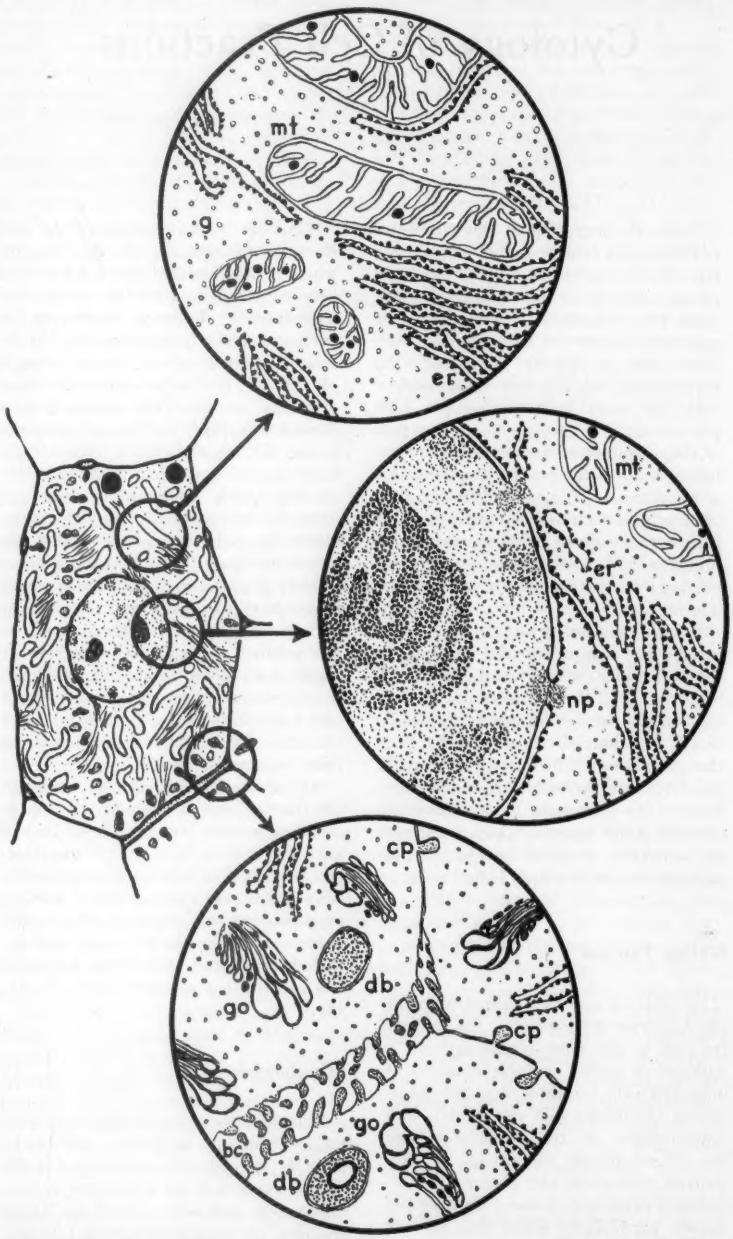

Fig. 1. Schematic representation of a parenchymatous cell of rat liver. The fine structure depicted is based largely on the following investigations: mitochondria (*mt*) (*26–28*); basophilic material (*er*) (*10, 11, 27, 38, 41*); glycogen (*g*) (*11*); nucleolus (*9–11*); nuclear membrane (*12*); nuclear "pores" (*np*) (*11–16*); Golgi apparatus (*go*) (*11, 18, 39, 48, 49, 51–53*); "dense bodies" (*db*) (*6, 7, 18*); interlocking cell processes (*cp*) (*11*); and bile canaliculus (*bc*) (*10, 11, 18*). Bile canaliculi are shown sectioned longitudinally at the right bottom of cell and transversely in five other regions (*2*). The linear arrangement of Golgi material to the left of the nucleus suggests a canaliculus oriented along the length of the cell but lying outside the plane of section. Lipid droplets are indicated by two solid spheres at one pole of the cell.

the specialized, often misleading, meanings that were given to the term *ergastoplasm* early in this century. This could, however, be countered with the observations (i) that, although Garnier (*43*) used the term for the filamentous structures of gland cells and oocytes, it was subsequently employed by French cytologists more generally for the basophilic substance of cells, and (ii) that many biological terms have undergone changes in meaning without loss of usefulness. On the other hand, those who preferred *ergastoplasm* to *endoplasmic reticulum* pointed to the uncertainty that the membranes, except in unusual cases, constitute a reticulum. However, apparently separate elements may be interconnected outside the plane of section (*42*) and, if Palade's description (*42*) of a continuity between this membranous system and the outer cell membrane proves to be of general occurrence, the term *reticulum,* if not the term *endoplasmic,* would emphasize a relationship of great physiological importance.

Agreement on terminology, sometimes made more difficult by considerations of national pride and human personality, appears to be close at hand, as we rapidly learn more about the membrane systems of cells. Porter's work (*44*) suggests that all cells possess a similar basic component—a vacuolar system of great complexity—and that in different cells this system shows varying degrees of continuity and specialization. Thus, according to this view, "ergastoplasm" is essentially a specialized type of "endoplasmic reticulum" characterized by the presence of basophilic granules on its surface.

I am suggesting that the term generally accepted by electron microscopists for the basophilic material of rat liver, whether it is *ergastoplasm* or another term, also be used for the microsome fraction of normal rat liver. What Harel and Oberling (*34*) have emphasized concerning "optical and electronical" cytologies applies also to biochemical cytology—they are all one cytology. Our knowledge of the "small" particles has advanced essentially to the same position as did that of the larger ones in 1948, when Hogeboom, Schneider, and Palade (*25*) demonstrated that many of the "large granules" had the shape and Janus-green stainability of mitochondria (*45*).

Undivided microsomal fractions of rat liver do not consist solely of granule-studded membranes. They contain considerable numbers of small nongranular membranes which may perhaps be derived from structures as diverse as Golgi apparatus, microvilli of bile canaliculi, and mitochondrial membranes. However, it is easier to obtain relatively purified granular membrane fractions by centrifugation procedures than mitochondrial fractions of equal purity. Not only are mitochondrial fractions contaminated by microsomes, but they generally contain particles such as "lysosomes." It is clearly desirable to separate the nongranular from the granular membranes of the microsome fraction (*46*), just as it is desirable to separate lysosomes and other particles from the mitochondrial fraction. Future work will indicate whether in other tissues the granule-studded membranes also constitute the major component of the fraction or whether other cytologic structures are relatively more important.

Golgi Apparatus

The only description of isolated Golgi material is that of Schneider, Dalton, and coworkers (*47*), with epididymis as the source.

No cytoplasmic structure has been debated with more passion among cytologists than the Golgi apparatus, nor has any structure been more frequently declared nonexistent. Thanks to the steadfast work of Dalton (*39, 48, 49*) and the more recent contributions of Sjöstrand and Hanzon (*50*), Haguenau and Bernhard (*51*), and others (*11, 18, 52, 53*), there can no longer be any doubt that a definite morphologic entity exists in the Golgi zone, at least of vertebrate cells. This consists of a system of smooth membranes, small granules and larger vacuoles. Baker (*54*) contends that the material generally called Golgi apparatus in invertebrates (and in the sympathetic neurone of the rabbit) is not homologous to the structure described by electron microscopists; electron micrographs of these cells could quickly settle the issue.

Electron microscopy also gives some support for the earlier speculations of cytologists that the Golgi material played some role in secretion and intracellular transport (*39, 50, 51, 53*). This makes further work on the isolation of this material for chemical analysis highly desirable. Such work with liver will be difficult, for the Golgi material is not abundant in this tissue. It has the same fine structure as in other tissues (*11, 18, 51*). Although it lies near the bile canaliculi, light microscope studies (*2*) indicate no connections between Golgi material and bile canaliculi such as are described by Gatenby (*55*). Electron microscopy will help determine what happens to the Golgi apparatus during homogenization, whether any remains with the bile canaliculi found in the nuclear fraction (*2*), and when isolated fractions are sufficiently pure to make chemical data meaningful. Polyvinylpyrollidone plus sucrose may be a helpful medium for maintaining the integrity of the Golgi material during isolation (*8*).

Other Cytoplasmic Granules

The recent work of De Duve and coworkers (*56, 57*) points to the possibility that some intracellular enzymes may be localized in cytoplasmic particles other than mitochondria and microsomes. They have found that a fraction which contains no more than 4 percent of the cell's nitrogen contains the major part of the activity of acid phosphatase and four other hydrolytic enzymes. To account for the biochemical data, they postulated the existence in this fraction of dense particles between 0.13 and 0.8 micron in diameter and surrounded by a semipermeable membrane, for which they suggested the name *lysosome*. Electron micrographs of these fractions have revealed the presence of hitherto undescribed particles ("dense bodies") that fit these predictions (*6, 7*). They have a mean length of 0.37 micron, contain tiny electron-dense granules, and some at least, possess internal cavities and external membranes. However, in the absence of highly purified fractions, it can not be asserted that these particles do in fact correspond to the postulated "lysosomes." These particles have also been seen near the bile canaliculi in electron micrographs of liver sections prepared in Bernhard's laboratory (*7, 18*). It is possible that the same or similar granules account for the distribution shown along the bile canaliculi of acid phosphatase and esterase, another hydrolytic enzyme, in Holt's cytochemical preparations (*58*).

Summary

It should be evident from this brief account that electron microscopy of thin sections is an invaluable asset in the study of fractions isolated by differential centrifugation. I have tried to indicate how the integrity of particles, purity of fractions, and the existence of new particles can be established through its use.

I have also suggested the desirability of a common terminology for all cytology—classic, electron-microscopic, and biochemical. Some have expressed the opinion that neutral terms such as *alpha, beta,* and *gamma membranes* (*59*) are more useful than *ergastoplasm, Golgi apparatus,* and so forth. As helpful as such neutral terms may be in *describing* intracellular structures, they do not appear to me to substitute for historically rooted cytological names.

Note added in proof: Since this article went to press there has appeared an important article by G. E. Palade and P. Siekevitz (*60*). These authors consider that the vesicles without granules found in the microsome fraction were "probably derived from the smooth surfaced

parts of the endoplasmic reticulum." The latter were found to be continuous with the granule-studded membranes; "the two varieties of profiles represent local differentiation within a common system." The authors confirm the finding of Rouiller (*18*) and Novikoff *et al.* (*7*) of the dense bodies adjacent to the bile canaliculi and describe their presence in the microsome fraction as a "minor component."

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R. R. Bensley, Cytologist

On 11 June Robert Russell Bensley died, aged 88 years. His was a full and enjoyable life. He was born on a farm near Hamilton, Ontario, on 13 November 1867 of an English-Canadian father and an Irish mother. Dr. Bensley liked to think of himself as Irish and, in truth, his cheerfulness—one might almost say buoyancy—generosity, and insight in character reading were remarkable. Probably his early family environment, supplemented by his training in English and the classics at school and the University of Toronto, contributed to his mastery of the English language and the clearness of his speeches and his writings.

In his third year of college he suffered a severe gunshot wound of the leg. He saved his life by promptly applying a tourniquet. Amputation was performed on the dining room table of the farm. Gangrene set in. There was another amputation high up in the thigh. Thrombophlebitis, septicemia, and bacterial endocarditis developed. There was much pain. The physician left the young patient to die with a pound of opium. But Bensley overcame the craving induced. During a long year of convalescence he read widely and studied all the farm animals and plants, with the help of a microscope bought for him by his father.

The year 1892 was another eventful one for Bensley. He graduated from Toronto in medicine, married Cariella May, and began the practice of medicine but continued to teach in the department of biology. His home for the rest of his life was a happy one, presided over by a devoted wife and blessed with children and eventually grandchildren.

Beginning in 1901 Bensley served in the department of anatomy of the University of Chicago, first as assistant professor and later as head, until his retirement in 1933. His life was bounded

by his home, his laboratory, and his summer place in the Go Home Bay Area of Ontario. He was in no hurry to record his achievements in published papers, and after publication he did not seem to care about the credit received. He discovered many keys to scientific treasure. These keys were improved or entirely new techniques. But the techniques themselves were useless unless used, just like door keys, he used to say. His distinction between the islets and acini of the pancreas by their staining reactions with supravital dyes and in other ways was fundamental to the preparation of insulin by Banting and Best.

But it was his investigations on mitochondria which are perhaps most illustrative of the man. As a penetrating reader of old German books he saw much of interest in Altmann's publications about "Elementarorganismen." He separated fact from fiction in Altmann's work and recognized among these elementary microorganisms what are now called mitochondria. He considered these to be "as characteristic of the cytoplasm as chromatin is of the nucleus," a conclusion that was received at the time with much skepticism.

Bensley, again delving in forgotten literature, found a report by Michaelis that bodies like mitochondria could be revealed in still living cells by staining with Janus green. Being a chemist, he realized that only Janus green of exactly the composition specified by Michaelis was effective. By introducing the right kind of Janus green, he made available an easy way to color mitochondria in living cells now employed by cytological laboratories the world over.

It was at this time (1909) that I commenced my training under Bensley. He gave the mitochondria problem to me complete without reservations. He himself kept away from it so that I would have a clear field. I made but little progress, so he returned to the attack 25 years later and in a very original way. The main issue was to find a way to make direct chemical analyses of mitochondria. He and his student, N. L. Hoerr (1934), broke living cells up and separated out the mitochondria by centrifugation. The mitochondria collected in this way were washed and analyzed. Not only did these two investigators supply the first facts relative to the chemical composition of mitochondria, but in doing so they devised a technique by which many other cellular constituents have since been collected and analyzed. This has thrown more light on the chemical structure of cells than any other procedure and was deserving of a Nobel prize.

Another advance of the first magnitude, and there were many, was made in Bensley's laboratory by his student, I. Gersh. It utilized and improved Altmann's long-ignored freezing and drying method. By this technique, fresh tissues are quickly frozen, dehydrated while still frozen, imbedded and sectioned without the use of any fixative. The elimination of the complications inseparable from the use of fixatives and the retention of chemical substances in the position they occupied during life have proved of the greatest service in studies on cytochemistry.

On 6 April 1953 in Chicago, Bensley, then 85 years of age, made the opening address of a symposium on the "Structure and biochemistry of mitochondria." The grand old man was in fine shape, his eyes sparkled, his voice was excellent, and the whole audience rose to honor him. His pioneer researches in cytochemistry are his monument, and his students, who loved him, will remember him thankfully as long as they live. (I am especially grateful for details to Dr. Bensley's former students: N. L. Hoerr, A. Lazarow, M. H. Knisely, and E. J. Stieglitz.)

E. V. Cowdry
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News of Science

International Atomic Energy Agency

With the signing of the statute of the new International Atomic Energy Agency, the conference which began at United Nations Headquarters on 20 Sept. concluded its work on 26 Oct. Seventy of the 81 governments that had participated in the conference's preparation of the 23-article statute have signed the document. The statute will be open for signature for 90 days and will enter into force when ratified by 18 states. Those countries whose representatives attended the conference but have not yet signed the statute are the following: Afghanistan, Burma, Iraq, Italy, Jordan, Mexico, Morocco, Nicaragua, Saudi Arabia, Tunisia, and Yemen.

At the closing of the meeting, Lewis L. Strauss, chairman of the United States Atomic Energy Commission, delivered a message from President Eisenhower. The message promised the President's support for United States official ratification of the agency's statute, an initial U.S. contribution of 5000 kilograms of uranium-235, and continued contributions of nuclear materials to match in amount the sum of all quantities made available by all other members of the agency for the period between its establishment and 1 July 1960.

The statute sets out plans for an international agency which "shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world." It provides that the agency shall insure, so far as possible, "that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose."

Besides completing the statute, the conference endorsed Vienna as the site for headquarters of the new agency and chose six elective members of the Preparatory Commission for the agency. This commission is composed of the 12 governments which, before the conference met, had been negotiating toward creation of the agency (Australia, Belgium, Brazil, Canada, Czechoslovakia, France, India, Portugal, the Union of South Africa, the U.S.S.R., the United Kingdom, and the United States), plus the six members elected by the conference (Argentina, Egypt, Indonesia, Japan, Pakistan, and Peru).

The Preparatory Commission will, among other things, make arrangements for the first session of the agency's General Conference, to be composed of all members of the agency; make designations for membership of the first Board of Governors; consider the recommendation of Vienna as the agency's headquarters; and enter into negotiations with the United Nations regarding the relationship of the two organizations.

The U.N. conference that has just

ended was sponsored by the 12 negotiating governments, which issued invitations to 87 countries—all members of the United Nations or of the specialized agencies. Eighty-two countries accepted the invitations and 81 actually participated in the conference. The number of participating countries was the largest ever present at a meeting at United Nations Headquarters. Officers of the Conference were Joao Carlos Muniz (Brazil), president, and Pavel Winkler (Czechoslovakia), vice-president. At the request of the sponsoring governments, U.N. Secretary-General Dag Hammarskjold served as secretary-general of the conference.

NSF Program to Make Research Results of Other Nations Available

United States scientists will be given broader access to results of research in other countries through the award of three new grants by the National Science Foundation. These grants, which total $89,910, provide for an expanded program of translation of Soviet scientific publications, establishment of a center to collect scientific translations from all languages, and procurement of a large number of relatively rare chemical publications from many different countries. In announcing the awards, NSF director Alan T. Waterman pointed out that, because the foundation supports basic research in the physical sciences, life sciences, earth sciences, engineering, and certain areas of convergence between these broad fields, these grants forecast a time when foundation programs of disseminating results of foreign research would gradually expand into all these areas.

First of the three grants, $57,860, was awarded to the American Institute of Biological Sciences, Hiden T. Cox, executive director. The institute will administer a program for translating and publishing four Soviet biological research periodicals, with the first English-language issues expected late this year or early 1957. The Russian publications to be translated include *Mikrobiologiia* (Microbiology), *Fiziologii Rastenii* (Plant Physiology), and *Doklady Akademii Nauk SSSR* (Reports or Proceedings of the USSR Academy of Sciences).

The first two will be translated from cover to cover and will appear six times yearly. Subscriptions, at $20 and $15 respectively, can be obtained from the American Institute of Biological Sciences, 2000 P St., NW, Washington, D.C. From the *Doklady*, principal publication of the Soviet Academy of Sciences, articles on zoological subjects and articles on botanical subjects will be translated and published in separate bimonthly periodicals. Subscription to the biological sciences translations from *Doklady* will be at $20 per year, while the botanical sciences section will be $7.

Second of the three new grants, $20,350, was awarded to the Special Libraries Association to operate a Scientific Translations Center to collect, announce, and sell photocopies of scientific translations of articles from all languages. The new program of the SLA Center, to be located at the John Crerar Library, Chicago, represents an integration of two smaller centers which have been in operation for several years.

SLA has operated a center at the Crerar Library to gather translations from all languages except Russian. Translations have been given or loaned to the center by Government agencies, industry, universities, and so forth, and announced through a monthly bibliography, *Translation Monthly*. For some time the foundation has supported the Library of Congress in establishing and operating a Russian Scientific Translation Center to provide the same service for scientists but providing Russian translations only. Library of Congress activities will be transferred to SLA at the end of 1956. The new SLA Center will thus begin with a collection of over 10,000 translations in science, technology, and medicine representing research from many countries. *Translation Monthly* will be subject indexed and greatly expanded beginning with the January 1957 issue. Its subscription price will remain at $5 per year.

The third grant is for $11,700, awarded to the Midwest Inter-Library Center, Chicago. The center, a joint operation of 16 midwestern universities and research libraries, will use the funds to acquire between 700 and 800 hard-to-get serial publications of chemical interest. It is believed that many of these publications are not received anywhere in the United States. When these publications are added to the extensive collected holdings of the members of the center, the result is expected to be one of the most complete collections of current periodical chemical literature anywhere in the world. The goal of the center, towards which this grant is an important first step, is to provide scientists with the original of any article abstracted in *Chemical Abstracts*, world authority on the periodical literature of chemistry.

In announcing these grants through its International Science Information Program, the NSF noted its past support of Soviet translations through the American Institute of Physics, American Mathematical Society, and Biological Abstracts, as well as its support of other types of projects designed to increase the availability of Soviet research information to English-reading scientists. Added to its previous efforts in this field, the three new grants widen the dimensions of the foundation program, which is now envisioned to consist of four major phases.

The first phase will seek to assure that original source material is obtainable within the United States so that when a scientist searches the literature to determine what previous contributions have been made to his particular problem, he can be reasonably sure of finding the original version of any research paper in his field. The second phase is to assist in translating any periodical or book important enough to be needed in a complete version. The third phase is to assist where necessary in publishing English abstracts of those foreign papers not translated in full. The fourth phase is to collect translations and information on translations so that a scientist need not inadvertently undertake to obtain a translation of a paper already available in English.

NIH Russian-English Translation Program

The National Institutes of Health has established a new program to help American scientists keep abreast of Russian medical research findings. Plans call for the translation and distribution of Soviet scientific medical information in the biological and medical sciences. Objectives of the program are similar to those of the National Science Foundation in the field of the physical sciences.

The program will include support for the republication in English of several representative Soviet journals and other Russian scientific publications. These will be distributed by the National Institutes of Health to medical and scientific libraries and to government agencies. These translated journals will also be made available for purchase. The first two Soviet journals selected under the new program are *Biokhimiia* (Biochemistry) and *Biulleten' Eksperimental'noi Biologii i Meditsiny* (Bulletin of Experimental Biology and Medicine).

A second phase of the program calls for the translation of sections of *Sovetskoe Meditsinskoe Referativnoe Obozrenie* (Soviet Medical Reference Review), an extensive abstract journal wholly devoted to Soviet contributions. The four sections provisionally selected for translation and publication are as follows: microbiology and infectious diseases; normal and pathological physiology, biochemistry, pharmacology and toxicology, oncology, and internal diseases.

The third aspect of the program involves the selection of a limited number of monographs for translation and publication. Selection will be made by a

special committee of scientists assembled for this purpose. Additional suggestions for significant Russian-language monographs are solicited by the National Institutes of Health from U.S. scientists.

Publication of a Russian-English medical dictionary and of a directory of Soviet medical and biological research institutes is also being planned.

Editor's note: Other organizations that conduct Russian translation programs are discussed on the editorial page of the 2 Nov. issue of Science.

News Briefs

■ Eleven staff members in the department of physics at Carnegie Institute of Technology, Pittsburgh, have issued a statement urging that this country seek an international agreement to end hydrogen bomb tests. At Yale University 13 scientists, including two department chairmen, also have urged a test ban. In recent weeks, such statements have been released by 11 groups of scientists [*Science* **124**, 925 (9 Nov. 1956)].

■ Seventy-six countries are represented at the UNESCO meeting that is under way in New Delhi, India. Stanley Allyn is head of the United States delegation to the conference, which is a plenary session that takes place every 2 years. It will end on 5 Dec.

■ The Japanese Government began its first uranium mining operation last month. Matsutaro Shoriki, chairman of the Japanese Atomic Energy Commission, touched off a charge of dynamite that officially opened work on developing deposits that were discovered at Okayama last year. Uranium deposits are also known to exist in western Honshu and in Tottori.

■ The U.S. Atomic Energy Commission has ready for distribution a tabulation of all the nuclear reactors built, building, or planned in the United States.

Scientists in the News

WILLIAM M. MANN, who has served for 31 years as director of the Smithsonian Institution's National Zoological Park, Washington, D.C., retired on 31 Oct. Mann began his government career in 1916 as an entomologist with the Bureau of Entomology, U.S. Department of Agriculture. He became director of the national zoo in 1925.

Under Mann's direction the zoo has become one of the best and most representative collections of living animals in the world. The physical equipment of the zoo also has steadily improved, and during Mann's administration four modern exhibition buildings have been added and others are planned.

Mann received his education at the State College of Washington, and Stanford and Harvard universities. At Harvard, where he earned his doctor of science degree, he studied under the renowned zoologist and teacher William M. Wheeler, and like Wheeler he has become an expert on ants. He has collected and studied ants around the globe, and only last year he presented to the Smithsonian Institution his huge personal collection of these insects, numbering more than 117,000 specimens.

Mann has made trips to many foreign lands to obtain live animals for the zoo's collection. For example, in 1926 he headed the Smithsonian-Chrysler expedition to East Africa, in 1937 a National Geographic Society expedition to the East Indies, and in 1940 the Smithsonian-Firestone expedition to Liberia. He has been particularly successful in obtaining rare species never before exhibited. Mann has writen many scientific papers, and his two books—*Wild Animals In and Out of the Zoo* and the autobiographical *Ant Hill Odyssey*—have brought his colorful life and work to a wide public.

Mann will continue his association with the Smithsonian in the capacity of honorary research associate, the institution's highest honorary scientific designation.

THEODORE H. REED, of Portland, Ore., who has held the post of chief veterinarian of the zoo since July 1955, has been named acting director of the National Zoological Park.

The Leukemia Society, Inc., New York, has presented the Robert Roesler de Villiers awards, under the society's Contest III, to the following men:

LEON O. JACOBSON, "In recognition of his pioneer experiments on the beneficial influence of local tissue shielding on general hematologic recovery after external irradiation—a fundamental discovery concerning a therapeutic weapon of continuing value in human leukemia."

JOHN F. LOUTIT (F.R.C.P.), "In recognition of his elegant and conclusive demonstration that general hematologic recovery after total body irradiation is enhanced by bone marrow cell colonization, even from a different species—a discovery of potentially great significance in the therapy of human leukemia."

ELIAS COHEN, formerly research zoologist at the Samuel R. Noble Foundation Inc., Ardmore, Okla., has been appointed a senior cancer research scientist at the Roswell Park Memorial Institute, Buffalo, N.Y.

WILLIAM B. DINSMOOR, professor of archeology at Columbia University and honorary president of the Archaeological Institute of America, was honored recently by Dickinson College at a special convocation during which he received an honorary degree. He was recognized for his work in excavating and restoring important Greek ruins. The Greek Government has awarded him the Order of Military Merit for his help with excavations of the Athenian Acropolis and with the restoration of the Propyaea of Acropolis.

GLENN T. SEABORG, Nobel prize winner and director of chemical research, Radiation Laboratory, University of California, Berkeley, will receive the 1957 Perkin medal of the American Section of the Society of Chemical Industry. The medal will be presented at a dinner in the Waldorf-Astoria Hotel, New York, on 11 Jan. 1957. Seaborg is being honored for the industrial implications of his work in nuclear chemistry.

JOHN P. NIELSEN, chairman of the department of metallurgical engineering at New York University, College of Engineering, has gone to the U.S.S.R. to lecture and attend a conference on atomic energy in Moscow and to visit metals institutes and plants in other parts of the country. He was invited by A. M. Samarin, a Soviet expert on steelmaking and deputy director of the Institute of Metallurgy in Moscow.

The New York Academy of Medicine's 22nd series of Lectures to the Laity will be devoted to "Medicine in the contemporary scene." The program follows:

PAUL H. HOCH, commissioner, department of Mental Hygiene State of New York, "Chemistry in mental disease," 14 Nov.

LEONARD A. SCHEELE, president, Warner-Chilcott Laboratories, "The state of the nation's health problems and their solution," 28 Nov.

PASTEUR VALLERY-RADOT, professor of medicine, Faculty of Medicine, University of Paris, France, member of the French Academy, "The logical sequence of Pasteur's discoveries," 12 Dec.

FREDERICK J. STARE, professor of nutrition and head, department of nutrition, Harvard University School of Public Health, "Nutrition in relation to family life in America," 9 Jan.

BENJAMIN SIMON, director, Ring Sanatorium, Arlington Heights, Mass., "Hypnotism—fact and fancy," 23 Jan.

WILTON MARION KROGMAN, professor and chairman, department of physical anthropology, Graduate School of Medicine, University of Pennsylvania, "Sickness and society," 6 Feb.

The following scientists are serving as visiting professors at Princeton University this year:

Department of aeronautical engineering. NATHAN N. BUDISH of the Boeing Airplane Company and Consolidated Aircraft Company.

Department of architecture. MARIO G. SALVADORI, professor of civil engineering at Columbia University.

Department of art and archeology. ERWIN PANOFSKY of the Institute for Advanced Study at Princeton, N.J.

Department of economics and sociology. PAUL J. BOHANNON, lecturer in social anthropology at Oxford University (England).

Department of mathematics. MICHAEL G. BARRATT of Brasenose College, Oxford (England); IRVING KAPLANSKY of the University of Chicago; GILBERT A. HUNT, JR., of Cornell University; STEPHEN C. KLEENE of the University of Wisconsin; and ONORATO T. T. O'MEARA of the University of Orago (New Zealand).

Department of physics. JOHN M. BLATT of Sydney University (Australia) and IGAL TALMI of the Daniel Sieff Institute in Rehovoth (Israel).

MORTON TEICHER, formerly of the University of Toronto in Canada, is head of the newly established department of social work at Yeshiva University. The new unit has programs leading to the master of science and doctor of philosophy degrees. At Toronto Teicher was associated with the School of Social Work and the department of psychiatry.

A. ASHLEY WEECH, director of the department of pediatrics at the University of Cincinnati College of Medicine, and also director of Cincinnati Children's Hospital, has received the $1000 Borden award of the American Academy of Pediatrics. He was honored for his fundamental contributions to pediatrics and "for his inspirational qualities as a teacher and leader of research in numerous aspects of child health and welfare."

DANIEL SWERN, a research chemist at the U.S. Department of Agriculture's Eastern Utilization Research Branch at Wyndmoor, Pa., has received the John Scott medal award from the Philadelphia Board of City Trusts for his inventions of new industrial chemicals from surplus animal fats. The award, $1000 and a medal, was presented during a meeting of the Philadelphia section of the American Chemical Society. Swern's research has resulted in the use of fats in plastics, paints, wire insulating materials, textile processing, and other industrial products and processes. Millions of pounds of fats now go into these uses each year.

Seven scientists and two health organizations have been chosen as winners of the 1956 Albert Lasker awards. The awards are given annually for outstanding achievement in medical research and public health administration. Since the establishment of the award program 10 years ago, nine Lasker award recipients have later received Nobel prizes. The 1956 winners are as follows:

ALAN GREGG of Big Sur, Calif., retired vice president of the Rockefeller Foundation. Cited as "elder statesman to science as a whole," Gregg will receive a special Albert Lasker award for 40 years of service in the fields of public health, medical education, and research in this country and abroad.

JONAS E. SALK, director, Virus Research Laboratory, University of Pittsburgh, Pa., for "distinguished achievement in developing a safe and effective protection against poliomyelitis."

WILLIAM P. SHEPARD, vice president for health and welfare, Metropolitan Life Insurance Company, New York, N.Y., for "influencing the health of all Americans as a pioneering industrial health physician, health educator, and government adviser."

V. EVERETT KINSEY, assistant director of research, Kresge Eye Institute, Detroit, Mich., and ARNALL PATZ, ophthalmologist, Baltimore, Md., joint award for "distinguished achievement in discovering excessive oxygen administration to be the cause of retrolental fibroplasia in prematurely born babies."

KARL MEYER, professor of biochemistry, Columbia University College of Physicians and Surgeons, New York, and FRANCIS O. SCHMITT, professor of biology, Massachusetts Institute of Technology, joint award for "pioneering studies of the biochemical components of connective tissues, contributing to new understanding of arthritis and rheumatic diseases."

Food and Drug Administration, U.S. Department of Health, Education, and Welfare, Washington, D.C., group award for "a half-century of public service in safeguarding the American people against contaminated or misrepresented products, and achieving a deserved public confidence."

Medical Care Program of the United Mine Workers of America Welfare and Retirement Fund, Washington, D.C., group award for "brilliant and dedicated scientific planning which has created a model program of health services for a million and a half workers and their families in mining towns from Alabama to Alaska, including construction of a network of 10 modern hospitals."

The presentation took place on 15 Nov. at the 84th annual meeting of the American Public Health Association in Atlantic City, N.J. The individual winners received prizes of $1000, leather-bound citations describing their accomplishments, and gold statuettes of the Winged Victory of Samothrace, symbolizing victory over death and disease. Group winners received silver statuettes. The special award carried a stipend of $2500.

JOSEPH BALLAM, formerly a research associate at Princeton University, has been named associate professor of physics at Michigan State University.

HARVEY V. MOYER has been promoted to the chairmanship of the Ohio State University chemistry department. A member of the faculty since 1929, Moyer had served as acting chairman of the department since the resignation of the late Edward Mack, JR., in 1955.

MELVIN CALVIN, professor of chemistry at the University of California, has been selected to deliver the annual Faculty Research Lecture for 1956–57. The lecture will be given next spring at Berkeley during the university's annual Charter Week observance. Calvin is the leader of a group of scientists who during the past decade have clarified the chemical process of photosynthesis. In citing this work, the Faculty Research Lecture Committee, which is headed by Edwin M. McMillan, Nobel laureate and professor of physics, said: "This intricate research must rank as one of the outstanding accomplishments of modern science and stands as an effective illustration of what can be accomplished through an ingenious utilization of a broad spectrum of the new scientific tools available today."

THOMAS G. DIGGES, a member of the metallurgy division at the National Bureau of Standards for 36 years, has been appointed assistant chief of the division. He will remain chief of the thermal metallurgy section.

HENRY W. SCHOENBORN of the University of Georgia has been appointed professor of zoology in the department of zoology at the University of Maryland.

JOHN D. STRONG, professor of experimental physics at Johns Hopkins University, has been awarded the Frederic Ives medal of the Optical Society of America "for distinguished work in optics." Strong has pioneered in the study of spectra of planetary atmospheres and has contributed to the extension of astrophysical measurements from the visible region, in which work has largely been concentrated, to longer wavelengths of the spectrum, including the far infrared.

WILLIAM F. MALONEY, assistant dean of the University of Minnesota school of medicine, has been appointed dean of the school of medicine at the Medical College of Virginia in Richmond, effective 1 Jan. 1957.

Recent Deaths

LESLIE H. BACKER, Summit, N.J.; 71; professor emeritus and former head of the departments of chemistry and chemical engineering at Stevens Institute of Technology; 27 Oct.

CARL EGGERS, New York, N.Y.; 77; former clinical professor of surgery at Columbia University and New York University; 24 Oct.

LOUIS FINDLAY; 44; chief of the health division of the United Nations' Relief and Works Agency for Palestine Refugees in the Middle East; 26 Oct.

NILS B. HERSLOFF, Coxsackie, N.Y.; 55; former instructor in clinical psychiatry at Columbia University; 25 Oct.

CHARLES S. JOHNSON, Nashville, Tenn.; 63; president of Fisk University; 27 Oct.

JOHN H. PARKER, Milwaukee, Wis.; 65; former professor of plant breeding at Kansas State College; 27 Oct.

MARION E. L. RICHARDS, New York, N.Y.; 62; retired assistant professor of botany at Barnard College; 26 Oct.

RUDOLPH J. SHAFER, Corning, N.Y.; 63; director of the Steuben County Laboratories; 29 Oct.

ALAN G. SLOCOMBE, Lexington, Mass.; 37; neurophysiologist at the Worcester Foundation for Experimental Biology; 18 Oct.

ARTHUR E. WATSON, Providence, R.I.; 91; professor emeritus of engineering at Brown University, who designed the electrical plant for the dirigible Shenandoah; 29 Oct.

Education

■ The seven high-school teachers who are this year's representatives of the Oak Ridge Traveling Science Demonstration Lecture Program are visiting schools throughout the nation in 1957 station wagons that have been provided through the courtesy of the Ford Motor Company. The ORINS University Relations Division is administering the traveling teacher program for the National Science Foundation in cooperation with the Atomic Energy Commission. The purpose of the plan is to stimulate interest in science and science-teaching careers.

During the course of the school year, the seven teachers will visit high schools in their assigned districts, spending a week at each. At every school, the traveling teacher will give special lectures and demonstrations before science classes. These sessions are designed to provide, simply and graphically, up-to-date information in many fields of science, from elementary chemistry to the principles of space travel.

During the visit, the teacher will also hold sessions and consultations with the science staff and other faculty members as a means of improving the teaching techniques.

The teachers will carry with them more than 800 pounds of demonstration equipment that they designed and built during a summer training period at Oak Ridge. Among the items, constructed to show students and science teachers the feasibility of making inexpensive apparatus, are an x-ray machine that cost $2.50 and a home-made Geiger counter assembled for less than $10.

The teachers expect to visit between 200 and 250 high schools in the 48 states and the District of Columbia during the present school year. Then they will return to Oak Ridge for preparation of final reports on their activities and discussion of ways and means to improve the program in the future.

■ New York University–Bellevue Medical Center has dedicated a new laboratory in honor of the late Joseph Goldberger. The laboratory will be used for the investigation of nutritional and metabolic diseases.

Goldberger, who died in 1929, was one of the university's most distinguished medical alumni. He devoted almost all of his life to research in the U.S. Public Health Service. His work resulted in the identification of pellagra as a nutritional disease that is preventable by proper diet.

■ An investigation of what is known about persons who want to become scientists has been begun by a research team from Teachers College, Columbia University. The team will examine the work that has been done in the field. It will summarize its findings in December and prepare a report in February.

Under a $20,000 grant from the National Science Foundation, the team will seek to furnish a guide for the financing of more important research projects in the choice of scientific careers. The directors of the project are Donald E. Super and Paul B. Bachrach of the department of psychological foundations and services at Teachers College.

■ Cornell University will receive a gift of a new civil engineering building. The donor is Spencer T. Olin, class of 1921. He has announced the gift in honor of his father, the late Franklin W. Olin, a civil engineering graduate in 1886.

Grants, Fellowships, and Awards

■ The National Academy of Sciences–National Research Council administers the following fellowship programs: Donner fellowships for medical research, Markle fellowships in the medical sciences, National Research fellowships in the medical sciences, and James Picker Foundation fellowships in radiological research. These awards are available to holders of M.D., Ph.D. or Sc.D. degrees who are not over 35 years of age. The basic stipend is $3800, with family and travel allowances. All but the Picker fellowships are limited to citizens of the United States and Canada. The deadline date for receipt of applications is *1 Dec. 1956*. Application material may be obtained from the Division of Medical Sciences, National Academy of Sciences–National Research Council, 2101 Constitution Ave., NW, Washington 25, D.C.

The Merck senior postdoctoral fellowships are also administered by NAS-NRC. These are available to U.S. citizens only, but there is no age restriction. Applicants must have had training in biology or chemistry equivalent to the Ph.D. degree and have had at least 3 years of postdoctoral professional experience. The stipend ranges up to $6000, as determined by the Fellowship Board. The deadline date for receipt of applications is *15 Jan. 1957*. Application material may be obtained from the NAS-NRC Fellowship Office. In addition, the Academy-Research Council receives applications, evaluates, and makes recommendations for the award of postdoctoral resident research associateships that are administered by Argonne National Laboratory, Lemont, Ill.; Oak Ridge National Laboratory, Oak Ridge, Tenn.; the National Bureau of Standards, Washington, D.C., and/or Boulder, Colo.; and the Naval Research Laboratory, Washington, D.C. These fellowships are available to holders of Ph.D. or Sc.D. degrees for advanced training in various branches of biological, physical and mathematical sciences. The gross stipends range up to $7035 (subject to income tax). The deadline date for receipt of applications is *11 Jan. 1957*. Application material may be obtained from the NAS-NRC Office of Scientific Personnel.

Similarly, the NAS-NRC assists the National Science Foundation with the following fellowship programs, which are available to U.S. citizens and are awarded on the basis of ability only. NSF graduate awards are available to individuals studying for either masters' or doctoral degrees. The stipend is $1600, $1800, or $2000, and the deadline date for receipt of applications is *24 Dec. 1956*. Application material for

both programs may be obtained from the NAS-NRC Fellowship Office.

NSF senior postdoctoral fellowships are available to scientists who have held doctoral degrees in one of the basic sciences for at least 4 years. These carry salary-matching stipends. In addition, NSF science faculty awards are available to college teachers who wish to enhance their effectiveness as teachers of science, mathematics, or engineering. The deadline for receipt of applications for these 2 programs is *14 Jan. 1957*. Application material may be obtained from the Division of Scientific Personnel and Education, National Science Foundation, 1520 H St., NW, Washington 25, D.C.

■ The Engineering College Research Council of the American Society for Engineering Education has announced plans for the new Curtis W. McGraw research award, established in memory of the late Curtis W. McGraw, president of the McGraw-Hill Publishing Company from 1950 to 1953 and brother of the present president, Donald C. McGraw. The award, sponsored by McGraw-Hill, will include a cash prize of $1000 and will be given annually beginning next June.

Candidates are to be young men "who have made original contribution in engineering research and who have demonstrated high potential for future leadership." The recipient of the McGraw research award will be selected each year by a special committee of the Engineering College Research Council; James R. Cudworth of the University of Alabama is chairman of this year's selection committee.

The first presentation of the award will be at the 1957 annual meeting of the American Society for Engineering Education, at Cornell University, 17–21 June. Nominations for 1957 should reach Cudworth *by 1 Feb. 1957*.

In the Laboratories

■ The General Electric Company's medium induction motor department, Schenectady, N.Y., has announced that it will invest $1.5 million in a developmental laboratory for the creation of new products and the improvement of present ones. The new facilities for motor research will include an engineering laboratory, an advanced engineering test area, and a development shop to investigate new manufacturing techniques to parallel product development. The engineering laboratory will undertake applied research and development work in electric insulation, bearings and lubrication, magnetic materials, metallurgy, and welding. A continuing search for improved insulation will be greatly intensified.

■ Robert A. Cooley, formerly with Olin Mathieson Chemical Corporation, has announced the incorporation of a new company, the Propellex Chemical Corporation, in Edwardsville, Ill. The new company will carry out research and development work on propellants and explosives.

■ The Mellon Institute, Pittsburgh, Pa., has announced plans for construction of a $1-million laboratory to house its recently established department of radiation research [*Science* **124**, 581 (28 Sept. 1956)]. The two-story, double-basement laboratory structure will be built on a newly acquired 125-acre rural tract located about 20 miles east of Pittsburgh near the town of Export, Pa. Other structures expected to be required by the institute's expanding industrial research programs will probably be built on the same site in the future.

■ The International Business Machines Corporation has announced plans for a new IBM Research Center in Yorktown, N.Y., 38 miles north of New York City. Options have been taken on a 224-acre site until a zoning variance is obtained for the construction of laboratories and administrative offices to accommodate the approximately 1600 staff members. The announcement follows the creation earlier this year of a separate group within the IBM engineering organization to consolidate all fundamental research aimed at improving the company's products. The work of this group will be guided by Emanuel R. Piore, recently appointed IBM director of research and formerly chief scientist of the Office of Naval Research.

No manufacturing operations of any kind will take place at the new research center. Eventually members of the present IBM Research Laboratories in Poughkeepsie, N.Y., will move to the new facility. The space vacated in Poughkeepsie by the research staff is to be occupied by expanding product development activities, which will remain there together with plants for the manufacture of electronic data processing machines and other products.

Miscellaneous

■ Thirty-five new technical problems for the attention of the nation's civilian inventors have been assigned by the Department of Defense to the National Inventors Council, U.S. Department of Commerce, the liaison agency between inventors and the armed services. These problems are published in a supplement to the council's cumulative list, *Technical Problems Affecting National Defense*. The supplement and the cumulative list may be obtained by writing to NIC, U.S. Department of Commerce, Washington 25, D.C.

An inventor who has a proposed solution to one of these problems may submit his idea to the council, which will evaluate it and, if it is practicable, present it to the proper military agency. Problems in the supplemental and cumulative list range through the fields of aeronautics, electronics, mechanics, plastics, chemistry, instrumentation, materials handling, metallurgy, and others.

■ Jack McCormick, who is in charge of vegetation studies at the American Museum of Natural History, New York, is organizing a series of regional vegetation bibliographies to treat of both the North and South American continents. The bibliographies are to be issued by the museum. It is hoped that scientists interested in vegetation studies will assist this project. Anyone having geographically arranged files which cover flora (other than strictly taxonomic works) or vegetation of all or any portion of the American continents is urgently requested to communicate with McCormick (American Museum of Natural History, Central Park W. at 79 St., New York 24, N.Y.).

■ The International Commission on Zoological Nomenclature has announced that, as from 30 Apr. 1957, it will start voting on the following cases involving the possible use of its plenary powers for the purposes specified against each entry. Full details of these cases were published on 31 Oct. in the *Bulletin of Zoological Nomenclature* (vol. 12, pt. 10): (i) *Encrinurus* Emmrich, 1844, and *Odontochile* Hawle & Corda, 1847, designation of type species for; *punctatus* Wahlenburg, 1821 (*Entomostracites*), validation (Class Trilobita); (ii) *Cupido* Schrank, 1801, designation of type species for (class Insecta, order Lepidoptera); (iii) *jurtina* Linnaeus, 1758 (*Papilio*), grant of precedence to, over *janira* Linnaeus, 1758 (*Papilio*); *EPINEPHELIDI* Tutt, 1896, suppression of (class Insecta, order Lepidoptera); (iv) *venulosa* Laurentus, 1768 (Hyla), determination (class Amphibia).

A proposal is also made for the adoption of the following declaration: determination of the relative precedence to be accorded to two or more names for family-group taxa published in the same book and on the same date. Comments should be sent as soon as possible in duplicate to Francis Hemming, secretary to the commission, 28 Park Village E., Regent's Park, London, N.W.1.

Erratum: In the article "Provincial universities in the United Kingdom," by Trevor I. Williams [*Science* **124**, 347 (24 Aug. 1956)], the names of the people identified in the picture on the left-hand side of page 348 were misspelled. The correct names are M. K. Das Gupta and R. C. Jennisson.

Reports

Studies on the Snake Mite, Ophionyssus natricis, in Nature

Ophionyssus natricis (Gervais, 1844) (Acarina: Dermanyssidae), the most serious parasite of snakes in zoological gardens throughout the world, has never been authenticated as occurring in wild reptile populations. Verbal reports of this mite in nature are either based on observations that have been made after hosts have been placed near captive reptiles, or else they refer to other forms such as pterygosomids, chiggers, or ticks. One recorded instance in which the mite was taken from a wild rat in Brazil is of little significance because of the proximity of a large reptile house to the collecting locality (*1*). The suggestion has been proffered that this mite may have evolved on reptiles in captivity, since the very behavior patterns that allow it to survive and prosper in this habitat were believed to preclude its existence on small snakes in wild situations (*2*). Recent collections in Giza Province, Egypt, however, reveal that *O. natricis* can and does exist in nature.

Eighty-two snakes representing eleven species were examined between January and May 1956 at various localities in this area. The mite was recovered from the following species: *Coluber florulentus* Jeoffrey, 1809, in Abu Ghalib, Abu Rawash, Kafr Hakim, Kirdasa, Minshat el Bakkari (Markaz Imbaba), and Zawyet Abu Musallam (Markaz Giza); *Psammophis sibilans* (Linnaeus, 1766) in Abu Rawash and Minshat el Bakkari; *Psammophis schokari* (Forskal, 1775) in El Mansuriya (Markaz Imbaba) and at the Giza Pyramids (Markaz Giza); *Spalerosophis cliffordi* (Schlegel, 1837) in Kirdasa and Zawyet Abu Musallam; *Naja haje* (Linnaeus, 1762) in Abu Ghalib; and *Telescopus dhara obtusus* Reuss, 1834, in Abu Rawash.

It was also found during the course of this study that large numbers of lizards, *Acanthodactylus boskianus* (Daudin, 1803) from the Lower Nile Valley, and *Acanthodactylus pardalis* (Lichtenstein, 1823) from Mersa Matruh (Markaz Matruh, Western Desert Governorate), harbored protonymphal mites that were indistinguishable from protonymphs of *Ophionyssus natricis*. However, lacertid lizards are known to be the hosts of species of *Sauronyssus* Sambon, 1928 (= *Neoliponyssus* Ewing, 1929), and the similarity (and possible synonymy) of the two genera prevent placement of these forms at this time.

Protonymphs also predominated on the afore-mentioned snakes, and it was necessary to rear them in order to obtain identifiable stages. Rearing was accomplished by placing the hosts in glass battery jars that contained a layer of moist sand and that were suspended over moats of water and detergent. The adult mites were recovered from the hosts or sand after the immature forms had molted. The afore-mentioned host records, however, are all supported by the subsequent finding of adult *Ophionyssus natricis* on all species concerned, with the exception of *Telescopus dhara obtusus*.

The most consistently and heavily parasitized host species was *Coluber florulentus*, only one out of 31 of which was free from mites. The density of infestation ranged from 14 to 109 mites, with an average of 39 per host. The mites were usually in the eye sockets and beneath the head, neck, and chin scales. Although mites were found on the body in heavy infestations, they were usually actively running about and not lodged beneath body scales. Of 18 *Psammophis sibilans* and 13 *P. schokari* examined, six of the former and four of the latter were positive, and none showed more than 15 mites per host. Again on these hosts, the mites were lodged anterior to the neck or were running freely over body scales. A single Egyptian cobra, *Naja haje*, harbored 50 mites in the left eye socket and beneath the posterior supralabial scales; elsewhere its body was free from infestation. Of five infested specimens of *Spalerosophis cliffordi*, out of six examined, one contained three female mites and seven freshly laid eggs in its right eye socket. An average of 22 protonymphs each were found on the other four *S. cliffordi;* all were lodged under the temporal scales or anterior to them. The only specimen of *Telescopus dhara obtusus* that was collected yielded a small number of protonymphal mites.

Although the occurrence of *Ophionyssus natricis* on certain snakes of this study may not necessarily indicate normal host-parasite relationships (it is possible that these reptiles had recently preyed upon one of the other hosts or had passed through an area that served as a focal point for hungry mites), these observations tend to indicate only slight host preference of this mite among different genera of snakes. Camin, studying the relationships of *O. natricis* to reptilian hemorrhagic septicemia, was able to utilize four genera of snakes, representing 11 different species or subspecies, as experimental hosts (*3*). This low degree of host specificity is in accordance with Bedford's observation that temporary parasites are generally less particular in their selection of hosts than are permanent parasites (*4*).

The intensity of infestation and the selection of feeding areas on the hosts in nature are interesting and should be compared with observations on populations in zoos and captive collections. On confined reptiles, mite populations sometimes approach thousands of individuals per cage and cause death of the host in 3 to 4 weeks. In light infestations, the mites are confined to the eye sockets and under the scales of the head, but as the population increases, they feed readily under the body scales of the snakes (*5*). In nature the most heavily parasitized snake harbored only slightly over 100 mites, and the choice feeding areas were observed to be in the eye sockets and beneath the scales anterior to the neck. The heavy mite population on captive reptiles is due to constant availability of hosts aided by utilization of larger feeding areas by the mites. Feeding from the large areas of distensible skin that generally underlie the body scales constitutes some danger to the parasite on more active, wild snakes. In contrast, the scales anterior to the neck, while imbricate, are nevertheless rigid enough to prevent dislodgement of the mite while the snake is in motion.

In addition to the afore-mentioned factors, certain other factors undoubtedly play a part in deterring such heavy infestation in nature. The "nest-parasite" existence of *Ophionyssus natricis*, typical of members of the family Dermanyssidae, was shown by Camin (*2*). He observed that the egg-laden female, larva, replete protonymph, and deutonymph remained in dark, humid places, where oviposition and molting occurred, whereas the newly molted protonymphs and adults lived on the host. The finding of only protonymphs and adults (with one exception) on the snakes examined in the present study would suggest that the life history in nature is similar in this respect. Not only, then, must the parasite twice seek and find a host, but it must also twice find suitable conditions in which to molt and oviposit. The low surface humidity prevalent throughout most of Egypt does not meliorate such activity. Furthermore,

only a small number of eggs are deposited by females, and the parasite is discarded with the sloughed skin each time the host molts. Clearly, further comparison between wild and domestic populations is desirable to determine ecological factors that influence host-parasite relationships under each of these widely divergent situations.

In view of these facts, it may be postulated that the sustaining hosts of *Ophionyssus natricis* in nature are reptiles that repeatedly visit areas that are compatible with the ecological requirements of the nonfeeding stages of the mites. Only those reptiles with small home ranges that are either abundant or gregarious will satisfy these conditions.

With the discovery of *Ophionyssus natricis* in nature, the opportunity is also presented to investigate the natural ecology of hemorrhagic septicemia in snakes, a disease entity that, like *O. natricis*, has heretofore been studied only in the laboratory (*5*).

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3. ———, *J. Parasitol.* 34, 345 (1948).
4. G. A. H. Bedford, *Rept. Director Vet. Services Animal Ind. Onderstepoort* 18, 223 (1932).
5. This investigation was supported by the Microbiology Branch of the Office of the Naval Research under contract No. NONR-1809(00). The opinions and assertions contained herein are mine and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large. I am grateful to Harry Hoogstraal, head of the department of medical zoology, NAMRU-3, for advice and facilities; to G. W. Wharton, head of the department of zoology, University of Maryland, for help and advice; to J. H. Camin, curator of invertebrates, Chicago Academy of Sciences, for active interest and suggestions during the course of this work; and to Hymen Marx, Chicago Natural History Museum, for identification of hosts.

23 August 1956

Action of Guinea Pig Serum and Human Gamma Globulin on the Growth of a Rat Tumor

The growth of the fibrosarcoma ACMCA2 that was transplanted into the AxC9935 strain of the Irish gray rat was found to be inhibited by repeated intraperitoneal injections of normal guinea pig serum following tumor transplantation. This inhibition is enhanced by a single injection of heterologous gamma globulin given at the time of implantation.

Preliminary experiments have shown

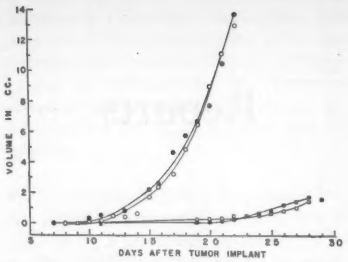

Fig. 1. Growth curves of the tumor in treated and untreated animals. Injections: ○ 5 ml of Ringer's solution daily; ● single injection of 28 mg of human gamma globulin plus daily injections of 5 ml of Ringer's solution; ■ 5 ml of guinea pig serum daily; □ single injection of 28 mg human gamma globulin plus daily injections of 5 ml of guinea pig serum.

that for this tumor, unlike other tumors that have been studied (*1*), multiple injections of guinea pig serum, rather than single or short-term injections, are required to produce the maximum inhibition. Treatment was therefore continued for 20 to 25 days (*2*).

Three series of experiments, with a total of 82 animals, were carried out (*3*). Thirty-two control animals were each given daily injections of 5 ml of Ringer's solution. Twenty-six animals were treated with daily injections of 5 ml of pooled guinea pig serum. Nineteen animals were given a single injection of 28 mg of human gamma globulin intramuscularly in the thigh in addition to the daily injections of guinea pig serum. Five animals were given a single intramuscular injection of 28 mg of human gamma globulin and daily injections of 5 ml of Ringer's solution. The animals were grouped so that litter mates were distributed in the different groups. The guinea pig serum was obtained commercially from heterogeneous colonies and stored in a Deep-freeze for 5 to 30 days. Human gamma globulin was obtained from Hyland Laboratories and dissolved in Ringer's solution with a concentration of 140 mg/ml.

In the first two series of experiments, the tumor was cut into pieces of weight 1.0 to 2.0 mg and implanted by trochar. In the third series, the Bernfeld and Homburger (*4*) modification of Snell's (*5*) cytosieve procedure was employed, and 0.1 ml of a 15-percent suspension was injected. In all cases the tumor was implanted subcutaneously in the back. Daily measurements were made in three dimensions with a vernier caliper during the course of treatment and for a short time afterward. The volumes were calculated from these data.

The results of the three series were combined, and the treated and untreated animals were compared using three criteria: (i) the positive or negative "take" of the tumor at the end of 65 days; (ii) the latent period, as determined by the time after implantation when a palpable tumor was first discernible; (iii) the time necessary for the tumor to reach a volume of 0.2 cm^3, at which time it was well into the logarithmic phase of growth.

The growth curves of the four groups are compared in Fig. 1. It will be seen that the treatment not only approximately doubled the time before the tumor entered the logarithmic phase of growth but also induced a slower rate of growth of the tumor.

The most significant finding is that the tumors in seven of the 19 animals that received guinea pig serum plus gamma globulin showed no growth at the end of the 65-day period. Two of these seven animals, however, had shown a small tumor which then regressed; one of these reappeared subsequently and again regressed. One of the 24 animals that was given guinea pig serum alone was also negative. One of the control animals was negative after implantation, and it remained refractory on subsequent implants.

The negative animals were reimplanted after 65 days (that is, 40 days after cessation of treatment), and all the tumors but one grew at a normal rate. The one grew to a volume of about 5 cm^3 and then regressed.

The effect on the latent period is graphically represented in Fig. 2. The appearance of the tumors is plotted on a probability scale. The lowest curve shows that the appearance of the normal tumor is a linear function of time. However, the curves of the treated animals deviate not only in the time of appearance, but in the rate of appearance as well.

When the time necessary for the tumor

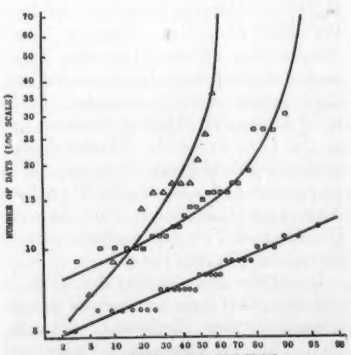

Fig. 2. Effect of treatment on the latent period of the tumor. The percentages of tumors are plotted on a probability scale. Injections: ○ 5 ml of Ringer's solution daily; □ 5 ml of guinea pig serum daily; △ 28 mg of human gamma globulin plus 5 ml of guinea pig serum daily.

to reach a volume of 0.2 cm^3 was plotted on a probability scale and compared with the curves of the treated groups, it was found that the curves were almost parallel. The curves of the two treated groups overlapped. The mean time for the tumors in the treated animals to reach this volume was again about double that of the controls.

The gamma globulin appears to act in one of several ways. By itself, in the dose used, it has no effect on tumor growth, although larger doses have a stimulating effect on the growth. When it is given in conjunction with guinea pig serum, it may suppress the growth of the tumor so that it does not appear at all, or it may have no added effect on the inhibitory action of guinea pig serum. Here also there is an optimum dose. The course taken is probably dependent on the tumor-host relationship.

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3. We are indebted to the Hancock Foundation for generously allowing us the use of its facilities. Our thanks are also extended to M. K. Barrett of the National Cancer Institute for information about the tumor, to the Hyland Laboratories for the gift of the gamma globulin, and to Clement J. Todd for aid in the statistics.
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24 September 1956.

Cholinergic Effects of β-Substituted Derivatives of Pyruvic Acid

As part of a continuing search for inhibitors of lactic dehydrogenase, fluoropyruvic acid (*1*) was studied *in vitro* in systems containing lactic dehydrogenase and then *in vivo* in rats (*2, 3*). Within 5 minutes after intraperitoneal administration of 150 mg/kg of fluoropyruvic acid, rats exhibited sialorrhea, lacrimation, and rhinorrhea, accompanied by wheezing and audible rhonchi. These effects were followed by lethargy, head drop, a decreased sensitivity to pain, occasional clonic movements, hyperpnea, labored breathing, and ultimately death of the animals in periods ranging from 30 minutes to 12 hours. In doses of 1 mg/kg, atropine suppressed the muscarinic effects of these compounds.

The specificity of the compounds causing these effects was investigated.

Table 1. Specificity of β-substituted pyruvic acids in producing cholinergic effects.

Positive effects	No cholinergic effects
Fluoropyruvic acid	Pyruvic acid
Chloropyruvic acid	α-Ketobutyric acid
Bromopyruvic acid	Oxaloacetic acid
Hydroxypyruvic acid	Fluoroacetic acid
	Chloroacetic acid
	Glycolic acid
	α-Chloropropionic acid
	Sodium fluoride
	Potassium oxalate
	Potassium oxamate
	Acetic acid

Chloropyruvic acid was synthesized by the method of Garino and Muzio (*4*), and bromopyruvic and hydroxypyruvic acids were synthesized by the procedure of Sprinson and Chargaff (*5*). As is indicated in Table 1, each of these β-substituted derivatives of pyruvic acid induced cholinergic effects in rats following intraperitoneal injection of 75–150 mg/kg. The effects of 2 and 3 carbon analogs of these pyruvic acid congeners were also studied (Table 1). The convulsant effects of fluoroacetic acid are well known, but this compound, like chloroacetic acid, does not induce cholinergic effects in the rat. Pyruvic acid itself and its β-methyl analog, α-ketobutyric acid (Sigma Chemicals Company), did not induce cholinergic responses.

The effects of β-substituted pyruvic acids were studied in other animals. In the mouse, chloropyruvic acid subcutaneously caused death in 1.5 to 12 hours and was found to have an LD_{50} of 200 mg/kg, closely approximating the value of 250 mg/kg reported by Blank *et al.* (*1*) for fluoropyruvic acid. Chloropyruvic acid produced analgesia in the mouse in less than 30 minutes, and the AD_{50} by the method of Haffner (*6*) was also found to be 200 mg/kg. As in the rat, the spontaneous activity of the mouse decreased, but activity could be readily evoked by sensory stimulation.

When 50 mg/kg of chloropyruvic acid was injected intravenously into spinal vagotomized cats, there was an initial fall followed by an increase in blood pressure and pulse pressure. These immediate effects were followed by a prolonged depression of blood pressure and pulse pressure. The cat also exhibited marked salivation, lacrimation, and rhinorrhea. Although instillation of 0.2 ml or 5-percent bromopyruvic or chloropyruvic acid in the conjunctival sac did not induce miosis in the rabbit, miosis was generally observed following intravenous injection of these compounds. Administration of acetylcholine in doses of 2 μg/kg to the cat resulted in a depressor response without an accompanying bradycardia prior to the administration of chloropyruvic acid. Following the administration of chloropyruvic acid, a marked bradycardia accompanied the depressor response to acetylcholine. Approximately 0.5 hour later, the depressor response to acetylcholine was noted again, but the bradycardia failed to recur. Flexion and extension of rear extremities with superimposed tremor were also observed following administration of chloropyruvic acid to the spinal cat. Administration of 1 μg/kg of norepinephrine after the administration of chloropyruvic acid did not result in a pressor effect.

Immediately after injection of 150 mg/kg of chloropyruvic acid in the cat, the EEG, which had shown frequent spindle activity, became activated and remained so for 8 minutes. During this time, there was a gradual diminution of the amplitude of the high-frequency activity. After 10 minutes, the EEG was characterized by spikes, abortive spindles, and slow wave activity. The activating response to auditory stimuli was still present and was longer than in the control period. The amplitude continuously decreased, and within an hour the cortex was isoelectric; however, single auditory stimuli produced evoked cortical potentials in the frontal, parietal, and occipital leads. These potentials were not artifact and are presumptive evidence that the activating system was still capable of mediating impulses to the cortex.

To test the possibility that the effects of the halogenated pyruvic acids were due to the formation *in vivo* of haloacetylcholines, which might be the direct stimulatory compounds, fluoroacetylcholine was synthesized by the method of Gryszkiewicz-Trochimowski *et al.* (*7*). Fluoroacetylcholine, in doses of 50 μg/kg, in the unanesthetized cat produced the cholinergic effects observed with chloropyruvic acid as well as bradycardia and motor activity of the rear extremities. After intravenous administration to rats of 15 mg/kg of fluoroacetylcholine, hemodacryorrhea was observed in the first 15 seconds and was followed within a minute by the other cholinergic effects observed with β-substituted pyruvic acids. The same effects in the rat were noted with acetylcholine at the same dose levels (*8*).

Inasmuch as the possibility existed that these compounds functioned as anticholinesterases, their effects were determined on the rate of hydrolysis of acetylcholine by purified bovine erythrocyte cholinesterase (Winthrop-Stearns). Neither fluoropyruvic acid, chloropyruvic acid, nor fluoroacetylcholine significantly altered the rate of enzymatic hydrolysis of acetylcholine.

However, the rate of hydrolysis of fluoroacetylcholine alone was 2–3 times that of acetylcholine and, like that of acetylcholine, was suppressed to spontaneous nonenzymatic levels by neostigmine. Thus, the limited duration of the cholinergic effects of both the substituted pyruvic acids and fluoroacetylcholine *in vivo* may be due to hydrolysis of the haloacetylcholines by cholinesterases.

Although the possibility exists that the substituted pyruvic acids form short acting anticholinesterases, it would seem more likely that the cholinergic effects of these compounds are due to their ready utilization by nerve cells and nerve ending as a source of haloacetyl or glycolyl fragments used for the rapid synthesis of substituted acetylcholines, which are then released at the nerve endings. The inactivity of the corresponding two carbon analogs, glycolic, fluoroacetic, and chloroacetic acids suggests that the acetate-activating enzymes at the nerve endings are absent or inactive.

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Mechanism of Action of Aldolase and Phosphotriose Isomerase

The aldolase-catalyzed condensation of dihydroxyacetone phosphate (DHAP) with various aldehydes is an enzymatic equivalent of nonenzymatic condensation reactions which involve labilization of carbon-bound hydrogen situated adjacent (alpha) to carbonyl groups. In alkali-catalyzed reactions of this type the hydrogen is considered to be labilized as a proton from the alpha carbon according to the scheme shown in Eq. 1. In the acid-catalyzed system hydrogen is thought to be labilized as a proton by the enhanced positive character of the carbonyl carbon (Eq. 2), where X^+ may be in any one of a variety of electrophilic reagents. It will be noted that in both formulations the activation consists in the formation of a resonance system consisting of carbanion and enol (C⟷E).

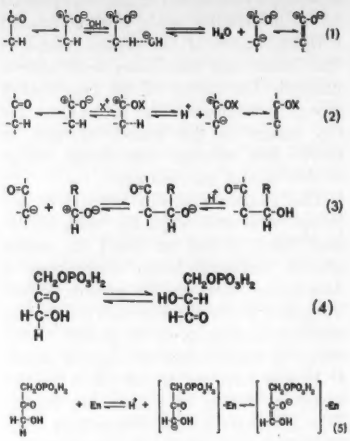
Subsequent reaction of C⟷E with the electrophilic carbonyl carbon of the aldehyde establishes a new carbon-carbon bond (Eq. 3).

Another metabolic reaction of DHAP consists in its transformation into D-glyceraldehyde-3-phosphate as catalyzed by phosphotriose isomerase (Eq. 4).

Details of the mechanism of these enzyme-catalyzed reactions have been sought through the following inquiries. (i) Is alpha hydrogen of DHAP labilized by aldolase in the absence of acceptor aldehyde? (ii) Is aldolase stereospecific with respect to the two hydrogen atoms residing on the carbon bearing the primary hydroxyl group? (iii) Is the polarization of the carbonyl group of the aldehyde intensified by aldolase? (iv) Does the triose-isomerase reaction involve the migration of a hydride ion or activation of a proton (*1*)? (v) Is phosphotriose isomerase stereospecific with respect to the two hydrogen atoms residing on the carbon bearing the primary hydroxyl group?

While these investigations were in progress preliminary reports (*2, 3*) by Rose and Rieder related to some of these inquiries have appeared.

The observation (*2*, and Table 1) that approximately one atom of carbon-bound hydrogen per mole of DHAP exchanges with the aqueous solvent on incubation with aldolase in the absence of acceptor aldehyde suggests that the mechanism shown in Eq. 5 is operative. It is thus apparent that the over-all condensation reaction can be broken down into at least two steps—namely, C⟷E formation from DHAP (Eq. 5) followed by the formation of a new carbon-carbon bond (Eq. 3). In other words, the presence of aldehyde on the enzyme surface is not a prerequisite for the labilization of alpha hydrogen in DHAP. Rose and Rieder (*2*) suggest a mechanism wherein the enzyme functions in a manner comparable to that described for hydroxyl ion catalysis. It should, however, be pointed out that the protonated enzyme could not dissociate from the C⟷E, since otherwise a loss of the stereospecific character of the reaction would result (see later). Other alternatives that should be considered are (i) that the functional center on the enzyme responsible for the activation of DHAP is an electrophilic site which enhances the polarization of the carbonyl group (Eq. 2), (ii) that *both* nucleophilic and electrophilic sites on the enzyme, in a "concerted" fashion, are involved in the activation of the substrate. The latter concept, that of



the enzyme acting as a polyfunctional catalyst, has been put forward by Swain and Brown (*4*).

The formation of a new carbon-carbon bond in the aldolase reaction is a consequence of electron sharing between C⟷E derived from DHAP and the electrophilic carbonyl-carbon of the aldehyde. In spite of the fact that this reaction is quite nonspecific with respect to the aldehyde moiety, it was conceivable that the condensation is promoted by enzymatic enhancement of the polarization of the carbonyl group. Such activation of the aldehyde, insofar as it would lead to increased positive character of the carbonyl-carbon, might be expected to result in labilization of alpha hydrogen. How-

Table 1. Incorporation of carbon-bound tritium into dihydroxyacetone phosphate.*

Expt. No.	Enzyme	Tritium uptake (μatoms/ μmole DHAP)
1a	Boiled aldolase	0.05
1b	Active aldolase	1.04
2a	Boiled aldolase	0.07
2b	Active aldolase	0.72
3a	Boiled isomerase	0.42
3b	Active isomerase	0.95

* Incubation conditions were as follows. The reaction mixtures contained per milliliter: from 3.56 to 6.25 μmoles of DHAP (*5*), 5 mg of crystalline aldolase free of phosphotriose isomerase (*6*) or 3.3 mg of crystalline phosphotriose isomerase free of aldolase (*7*), 50 μmoles of triethanolamine-HCl buffer, *p*H 7.0, 0.5 mc of tritium oxide. Incubation was at room temperature for 30 minutes; the reaction was stopped by freezing. The residue obtained after lyophilization was treated with absolute ethanol in order to inactivate the enzyme. Following removal of the alcohol the remaining exchangeable tritium was eliminated by repeated addition and removal of water. The final residue was taken up in 10 ml of 1/19/80 H_2O, absolute alcohol, and 400 mg percent diphenyloxazole in toluene and assayed for tritium by scintillation counting.

ever, when 0.27*M* acetaldehyde in tritium oxide was incubated for 30 minutes at room temperature in the presence of aldolase, no tritium was detected in the isolated dimedon derivative. This finding, taken in conjunction with the observed failure of fructose-1,6-diphosphate to incorporate tritium in the presence of aldolase (*2*), indicates that the enzyme does not, either in the presence or absence of DHAP, significantly exalt the polarization of the aldehyde carbonyl function. From the foregoing considerations it appears that the formation of C ⟷ E from DHAP is the sole detectable activating function of aldolase.

The observation has been made (*1*) that when fructose-6-phosphate is incubated with phosphoglucose isomerase in deuterium oxide the product, glucose-6-phosphate, contains one atom of deuterium per mole. This finding reveals that the isomerization is mediated by labilization of a proton leading to C ⟷ E formation rather than through a hydride ion migration. The data in Table 1 and results reported recently (*3*) demonstrate that approximately one atom of tritium is incorporated per mole of DHAP incubated with phosphotriose isomerase. Thus it would appear that the mechanism of isomerization of triosephosphate (Eq. 4) is identical with that of hexose phosphate. The same stereochemical relationships as described for the hexose isomerase reactions (*1*) would apply here; that is, either the *cis* or the *trans* enediol, but not both, is the intermediate in the interconversion of DHAP and D-glyceraldehyde-3-phosphate. The formation of L-glyceraldehyde-3-phosphate, if it occurs, would presumably involve the other enediol.

Mechanistically the aldolase and phosphotriose isomerase reactions have two features in common; that is, both involve C ⟷ E formation and both activate only one hydrogen atom per mole of substrate. The latter observation suggests that both enzymes are capable of distinguishing between the two hydrogen atoms on the primary carbinol. It was of further interest to determine whether the hydrogen which is labilized by aldolase is the same as that labilized by phosphotriose isomerase. When DHAP containing carbon-bound tritium, introduced by the action of aldolase in tritium oxide, was again subjected to the action of aldolase in hydrogen oxide a complete loss of tritium occurred. A similar incubation of labeled substrate with phosphotriose isomerase resulted in no significant loss of tritium. These results and those previously reported (*3*) clearly show that each enzyme acts on a different alpha hydrogen. Here then, are two more examples of substrate-enzyme relationships in which the Ogston concept applies; that is, at least three sites are implicated in complex formation. Two of these sites must involve the hydroxyl and one of the hydrogen atoms of the carbinol.

As is pointed out in a foregoing paragraph, C ⟷ E formation is a common feature of the aldolase and phosphotriose isomerase reactions. This finding, taken together with the observation related to the stereospecific character of these enzymes suggests that in the one case a *cis*-enediol is involved, while in the other a *trans*-enediol is implicated (*1*).

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12 July 1956

Plasma 17-Hydroxycorticosteroid Changes Related to Reserpine Effects on Emotional Behavior

Recent studies of adrenal-pituitary activity and behavior have shown that marked elevations of plasma 17-hydroxycorticosteroid (17-OH-CS) levels can be selectively related to conditioned emotional response patterns of the "fear" or "anxiety" type in laboratory animals (*1*). Disruption of lever-pressing behavior for a liquid reward by thirsty monkeys in response to the presentation of an auditory stimulus that had previously been paired with an electric shock was found to be accompanied by plasma 17-OH-CS increase at the rate of 20 to 25 μg percent per hour. A closely related series of experiments has also shown that chronic administration of reserpine can markedly attenuate the suppressing effect of the conditioned anxiety stimulus on lever-pressing behavior (*2*). This series prompted a further analysis of the interrelationships between such drug activity and the adrenal-cortical response to emotional conditioning.

Rhesus monkeys that had been deprived of solid food and liquids for 24 hours or more were trained to press a bar for a reward of sugared orange juice. When the response rates had stabilized, the conditioned emotional response was superimposed on the lever-pressing behavior by repeated presentation of a 5-minute clicking noise that was terminated contiguously with a painful electric shock to the feet. After a few such pairings, the anxiety response appeared as a disruption of the stable lever-pressing pattern, accompanied by crouching, trembling, piloerection, and frequently urination and defecation.

Experimental sessions lasting 1 hour consisted of six such 5-minute clicker presentations with 5-minute periods of no clicker between each trial. Blood samples were drawn before and after each session, and the plasma was analyzed for 17-OH-CS concentrations by the Nelson-Samuels method (*3, 4*). Base lines were determined for plasma 17-OH-CS responsiveness to the anxiety stimulus alone and to control procedures including lever-pressing alone after conditioning. Figure 1 shows the selective increases in steroid output related to the anxiety conditioning situation as compared with the control procedures.

Following several such base-line determinations and unequivocal establishment of the relationship between plasma corticosteroid increase and the emotional behavior, daily intramuscular doses of reserpine (0.75 mg/kg) were administered 20 to 22 hours before the time of the experimental sessions (*5*). Figure 2 shows the effects of these treatments on the behavioral response to the conditioned anxiety stimulus and on the corticosteroid response during such experimental sessions for one monkey. The strength of the anxiety response is indicated on the left ordinate of the curve in terms of "inflection ratios" (*6*), a

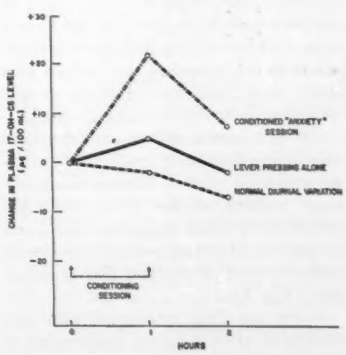

Fig. 1. Plasma 17-hydroxycorticosteroid levels during anxiety conditioning sessions compared with control levels during lever-pressing sessions without the emotional stimulus and compared with normal diurnal levels.

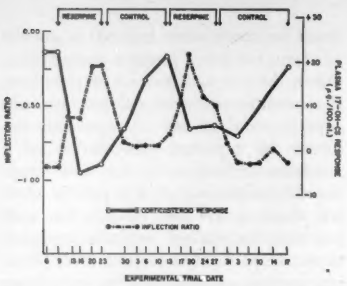

Fig. 2. Effects of reserpine on the emotional response and on the levels of plasma 17-hydroxycorticosteroid during anxiety conditioning sessions.

measure derived from comparing the number of lever responses during the 5-minute periods with lever responses during the 5-minute intervals between clickers. Inflection ratio values near 0.00 indicate that an approximately equal number of lever responses were emitted during and in the absence of the clicker (no disruption of the rate by the anxiety stimulus), and values near – 1.00 reflect virtually complete suppression of the lever-pressing rate during the operation of the clicker. Inflection ratio values between 0.00 and – 1.00, then, indicate progressively greater degrees of suppression of lever-pressing as a consequence of the clicker presentations. The corticosteroid response is indicated on the right ordinate of the figure; it is expressed in terms of micrograms per 100 ml of plasma change during the 1-hour experimental session.

The control points on the figure taken before reserpine treatments were initiated show the relationship between suppression of lever pressing in the anxiety situation and elevation of corticosteroid levels during such a session. Within 1 week following daily reserpine administration, however, suppression of the lever-pressing response by the anxiety stimulus had virtually disappeared (indicated by the inflection ratio values near 0.00), and corticosteroid levels showed no elevation during the experimental sessions. As a matter of fact, even the slight rises in corticosteroid levels that usually accompanied control lever-pressing sessions without clicker after emotional conditioning failed to appear. The levels during this treatment period more closely approximated the normal diurnal variation (Fig. 1).

When the drug treatments were discontinued after 2 weeks, suppression of lever pressing by the anxiety stimulus reappeared (inflection ratios approximating – 1.00), and corticosteroid elevations of about 20 μg/100 ml of blood were again recorded during the experimental sessions. Finally, readministration of reserpine following recovery of both the behavioral and the steroid response to the anxiety stimulus again produced attenuation of both the psychological and physiological reactions, with subsequent recovery following withdrawal of the drug.

Clearly, the striking correlation between the alterations induced by reserpine in lever-pressing rate and in adrenal-cortical activity during anxiety sessions suggests that the relationship between these behavioral and endocrine responses is an intimate one. There is some indication in the present data, however, that recovery of the plasma corticosteroid response following withdrawal of reserpine may proceed somewhat more slowly than the reappearance of the emotional response to the anxiety stimulus.

Although the suppression of lever pressing was again apparent within 1 week after withdrawal of the drug, the steroid response to the anxiety stimulus did not completely return to normal until the third week after cessation of treatment. The fact that the recovery periods differed somewhat in length could indicate that the neural mechanisms underlying the two responses may be, at least in part, independent. The precise definition and specification of such psychophysiological relationships, however, remain for future research to delimit (7).

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10 August 1956

Occurrence of a Bitter Principle in Carrots

Bitterness in carrots is a serious problem in some of our vegetable-producing states and is annually causing a considerable loss to the industry. Bitterness has been associated with carrots having a low alpha-carotene content (1), with carrots infected with aster yellow virus (2), and with stored carrots that have been grown in muck soils (3). Although no bitter principle has been isolated from carrot roots, a syrupy bitter glycoside has been isolated from carrot leaves (4), and another bitter glycoside has been isolated from the seeds of red carrots (5). Neither of these substances was crystalline, and therefore the identity of these materials remains doubtful.

Table 1. R_f values of a crystalline bitter principle of carrots and the acetone extracts of bitter carrots on Whatman No. 1 filter paper (8).

Solvent	R_f values	
	Crystalline principle	Acetone extracts of bitter carrots
Water	0.44	0.44
Phenol saturated with water	0.97	0.97
Acetic acid (15 percent)	0.74	0.74
Heptane: 1-butanol: water (29:14:57 by vol.)	0.58	0.58
Ethylacetate: ammonia (2*N*) (1:1 by vol.)	0.55	0.55

Because of the current interest in the flavor problem of this important vegetable crop, an investigation was begun to isolate and characterize compounds that are responsible for bitterness (6).

Previous workers have reported two methods for measuring the bitterness of carrots (7), both based on absorption in the ultraviolet region. In an attempt to identify the bitter principle, R_f values on paper chromatograms were determined in five different solvents for acetone extracts of bitter carrots, and the crystalline compound was isolated from bitter carrots (Table 1). The isolated crystalline compound has the characteristic absorption in the ultraviolet region used in the methods previously mentioned (7), the same R_f values as the substances in the bitter carrot extract, and the identical flavor of bitter carrots.

Fourteen bushels of bitter carrots were dried in a forced-draft oven for 3 hours at 60°C. The dried carrots were ground in a Wiley mill to pass a 2-mm sieve. Twenty pounds of the ground material was extracted in a large Soxhlet unit with acetone for 8 hours. The acetone was removed under reduced pressure until crystals began to separate from the solution. One hundred milligrams of bitter crystals were obtained; these were recrystallized from aqueous methanol

until a constant melting point was attained. The colorless platelets melted at 77°C and were soluble in chloroform, ethyl ether, water, and methanol. Sodium fusion indicated the absence of halogens, sulfur, and nitrogen. A molecular weight of 268 was obtained by the Rast camphor method, and elemental analysis showed that the compound contained 63.94 percent carbon and 5.86 percent hydrogen. These data suggest an empirical formula of $C_{15}H_{15}O_5$. The ultraviolet absorption spectrum in methanol revealed a maximum at 268 mμ and minima at 242 mμ and 287 mμ. The infrared spectral analysis in chloroform showed a maximum at 6.01 μ.

A search of the literature failed to reveal a discussion of a compound approximating $C_{15}H_{15}O_5$ and having the previously mentioned properties.

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23 July 1956

New Chemical Method to Differentiate Human-Type Tubercle Bacilli from Other Mycobacteria

No morphological or immunological method to differentiate the various types of mycobacteria exists at the present time. All attempts to find a type-specific skin reaction have also failed. The only methods in current use are based on cultural and pathogenic characteristics. This paper describes chemical methods that are dependent on the metabolic properties of mycobacteria.

Pope and Smith (*1*) determined the vitamin-B production in the culture filtrate of human and bovine tubercle bacilli, respectively, grown on synthetic liquid media. Bird (*2*) also measured the vitamin-B content of human tubercle bacilli.

Konno and coworkers (*3*) reported on a marked quantitative difference in the niacin production by human-type tubercle bacilli and other mycobacteria when grown on synthetic culture media. This difference is strictly linked to the type of the bacillus.

The present investigation aims at simplification of the previous method by using colonies of bacilli taken directly from the routine solid diagnostic media. The following materials were used: 15 strains of standard laboratory mycobacteria (Table 1), 50 strains of tubercle bacilli obtained from tuberculous patients, including three isoniazid-resistant, catalase-deficient strains, which did not cause progressive tuberculosis in guinea pigs, and 10 strains of "atypical acid-fast bacilli," most of them chromogens (Table 2). These laboratory and clinical materials were inoculated on the Loewenstein-Jensen's solid culture media and allowed to grow from about 1 to 3 months.

For the estimation of niacin, the aniline and cyanogen bromide method (*4*) is used; a few colonies are carefully taken from the culture medium by a platinum loop and transferred into a test tube that contains 1 ml of 4-percent aniline solution (*5*). To this is added 1 ml of 10-percent cyanogen bromide (*6*). A positive test shows the development of an intensive canary-yellow color first noticed in the bacterial sediment of the test tube and later, after shaking, in the supernatant fluid. A positive test is developed only by human-type tubercle bacilli, whereas the other mycobacteria (bovine, avian, nonpathogenic mycobacteria and the group of "atypical acid-fast bacilli") do not develop an appreciable yellow color.

Controls with malachite green-containing medium showed a green discoloration of the fluid. Controls with aniline solution and bacilli or cyanogen bromide solution and bacilli show no color production. The color production by this aniline-cyanogen bromide method is more intense than the previously used metol and cyanogen bromide method (*7*) or the ammonia buffer and cyanogen bromide method (*8*).

As mentioned before only human-type tubercle bacilli give a positive test, irrespective of virulence. This was confirmed with standard laboratory strains as well as with strains obtained directly from patients; no difference in the test was noted between isoniazid-sensitive or resistant, catalase-producing or deficient strains. Bovine tubercle bacilli, whether highly virulent or as attenuated as the B.C.G., show a negative test. Avian tubercle bacilli, nonpathogenic bacteria, and all "atypical acid-fast bacilli" studied to date give negative tests.

Table 1. Niacin test of standard laboratory mycobacteria.

Type	Strain	Niacin test
Human tubercle bacilli	Virulent	
	1) H37 Rv	+
	2) Campbell	+
	3) Erdman	+
	Attenuated	
	4) H37 Ra	+
	5) JH 16 Ra	+
	6) JH 6 Ra	+
Bovine tubercle bacilli	Virulent	
	7) Vallée	−
	8) Ravenel	−
	Attenuated	
	9) B.C.G.	−
Avian tubercle bacilli	10) Sheard	−
	11) Camden	−
	12) Avian I	−
Nonpathogenic mycobacteria	13) *M. ranae*	−
	14) *M. phlei*	−
	15) M. 607	−

Table 2. Niacin test of tubercle bacilli and "atypical acid-fast bacilli" obtained from patients.

Fifty strains of tubercle bacilli including three isoniazid-resistant, catalase-deficient strains	Niacin test positive 50	Niacin test negative 0
Ten strains of "atypical acid-fast bacilli"	Niacin test positive 0	Niacin test negative 10

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22 August 1956

Book Reviews

Gaseous Nebulae. vol. 3. International Astrophysics Series. L. H. Aller. Wiley, New York, 1956. 322 pp. Illus. $11.

This book is the third in the recently started International Astrophysics Series edited by Ellison and Lovell. It also happens to be the third monograph written by L. H. Aller to be published within a few years. Therefore the indication volume 3 on the back of the book is rather misleading because, if I understand it correctly, the volume 3 refers to the International Astrophysics Series and not to the series of books by Aller, as one might gather from the back of the book.

One has to be grateful to Aller for providing us with another volume containing a wealth of material, both observational and theoretical, presented in a clear and concise manner. After a brief introduction, the second chapter discusses in great detail various observational techniques for observing diffuse nebulae as well as planetary nebulae. The third chapter discusses distances, dimensions, and spectra of gaseous nebulae, and one is once again struck by the fact that the theoretical astrophysicist must have a much more elaborate *working* knowledge of atomic physics (and also of other branches of physics) than the ordinary theoretical physicist who can often get away with specializing in a rather narrow field.

The fourth chapter discusses physical processes in gaseous nebulae. The author restricts himself mainly to the discussion of a model of a planetary nebula which is a homogeneous spherical shell of hydrogen gas surrounding a very hot star, assuming a steady state to have been attained. As is well known from similar astrophysical problems, the situation is a good deal more complicated in such a state where there does not exist true thermodynamic equilibrium than in the usual situations discussed in statistical thermodynamics.

In Chapter 5 the author discusses the problem of forbidden lines. A slight point of criticism is that I feel that he might have said a few words illustrating why magnetic dipole, quadrupole, and higher order lines are usually not observed. Chapter 6 discusses the stars that illuminate the gaseous nebulae, and Chapter 7 describes the structure and internal motions of planetary nebulae. It may be added here that the main subject of the monograph is planetary nebulae, the diffuse nebulae being discussed very briefly, since they can be considered to be part of the interstellar medium, which will be discussed by Spitzer in another volume of the International Astrophysics Series. In the last chapter the author discusses some aspects of the diffuse nebulae.

"The aim of the International Astrophysics Series is to provide a collection of authoritative volumes dealing with the main branches of astrophysics. . . . The books will be suitable for both specialists and students. Some of the titles may have a wider and more popular appeal but this will be secondary to the main purpose, which is to assist in the teaching of astrophysics and radio astronomy and in the advancement of these subjects themselves." The present monograph falls beautifully into the category which the editors have had in mind, and it should provide one of the standard textbooks on the subject for some time to come. It seems, however, to me that it will be impossible for the general reader to get much benefit from this volume, unless he has a sound working knowledge of astrophysics.

D. TER HAAR
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Encouraging Scientific Talent. A study of America's able students who are lost to college and ways of attracting them to college and science careers. Charles C. Cole, Jr. College Entrance Examination Board, New York, 1956. 259 pp. $3.50.

Those of us who were completing our formal education and were looking for academic or industrial posts in the early 1930's find it hard to believe our eyes and ears today. We probably would have labeled as insane anyone who had then suggested that, within 25 years, several pages of the Sunday *New York Times* would be devoted weekly to advertising for scientists and engineers, or that a manufacturer would dedicate his commercial time during a national telecast of a football game in order to suggest that persons in these fields make phone calls or send telegrams to his personnel officers. Yet the current shortage of scientific and technical people is so acute that these things are happening, and beginning salaries for men fresh from their A.B., B.S., or Ph.D. degrees are increasing year by year. If the trend continues, we may even expect that the average salaries of mature and experienced scientists will approximate those of other professions—in which case we shall really believe that the shortage is real and not a result of the necessity of hiring degree holders for work on cost plus contracts.

Encouraging Scientific Talent is the most recent book-length contribution to the growing literature on the shortage of scientists. After devoting three chapters to a discussion of the nature of science, the characteristics of the scientist, and the present manpower situation in science and engineering, Charles Cole devotes the rest of his book to one specific study. What are the reasons that a high-school student of high aptitude does or does not enter college? To what extent do teaching, the influence of parents, social pressures, and economic status determine his or her decision? What can be done to see that every student with ability wants to enter college and has the opportunity to do so? Most of the chapters are thoroughly documented by references to statistical studies, including a special survey of more than 32,000 students in 478 schools throughout the country. To the extent that questionnaires, tests, and psychological studies can give the answers to important questions, this book should form the basis of future discussions and planning on the part of colleges, universities, federal and state governments, and educational foundations.

The book will be provocative, if not completely satisfying, even to those who are not convinced that answers to all questions can grow from statistical studies. For example, the author shows that the percentage of college-age youths who actually attend college in each state correlates very well with the per capita income of the state, the annual state expenditures for public schools, and the percentage of workers who are engaged in professions within the state. One state, however, fails to fit the pattern. Utah stands head and shoulders above all others in sending students to college, although it is in the middle group according to the other measures. If the unusual happening is what offers challenge to a scientist, some of us should devote our energies to finding out what it is in the intellectual climate of Utah that produces this remarkable result.

Although it is never explicitly indicated, there seems to underlie Cole's treatment an assumption that education

to the limit of the student's capacity has ceased to be a privilege and has, instead, become a duty. This may well be in keeping with the problems and the temper of the times, yet it raises a question whose wide political and moral implications should be considered very carefully.

The cost of the book and the scholarly manner in which it is written and documented may prevent it from having the wide influence which this careful study deserves.

WALTER C. MICHELS
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Child Development and Personality. Paul H. Mussen and John J. Conger. Harper, New York, 1956. 569 pp. Illus. $6.

Since the turn of the century, child psychologists have been busily gathering a myriad of facts about their young subjects. Until recently, they have cataloged their findings in encyclopedic textbooks, stringing one fact after another rather precariously on the single strand of age development. The 3-year old does this, the 4-year old that. Child development progresses, apparently, with certain setbacks which at times impair the symmetry of the growth curves, but, in the past, textbooks have paid less attention to what may have preceded the setbacks than to the over-all (and by now reasonably dull) proposition that there is psychological growth with age. The fact is that, for most of the last half-century, child psychology has been purely descriptive, and the why's and wherefore's have been left to speculation.

In truth, it is difficult to escape the overpowering influence of the age factor in dealing with children. There is a certain regularity of development. On the other hand, there is an inescapable fact that many children of any one age have remarkably different personalities, and this fact, too, must be taken into the picture. Paul Mussen and John Conger have resolved this conflict between regularity (within very wide limits) and individual differences by examining the variations in children's experience. They have used a social learning interpretation of the researches at their disposal to analyze the many aspects of personality development. By this device, they have been able to avoid the purely descriptive approach and have been able to make a useful investigation of development in terms of antecedents and consequents. "The child's behavior, interests, attitudes and feelings are discussed from the points of view of: (1) factors in the child's background (biological, psychological, or social—and of course age is not neglected—) leading up to and influencing the development of these characteristics, and (2) the importance of these characteristics for the child's future development" (p. 7). What eventuates from this approach is a remarkably fruitful evaluation of the current state of our knowledge about the complicated process of personality development. This book will be welcomed, for this among other reasons, both by students of child psychology and by scholars in other fields—teachers, social workers, parents, pediatricians—whose work involves understanding of children's development.

Like most other contemporary child psychologists, Mussen and Conger attempt an evaluation of genetic factors in development before they examine the social learning factors in children's growth. It is in the latter area, however, that the most stimulating findings seem to have emerged recently. Some are at variance with one another, and many are imbued with that heat of controversy which inevitably seems to arise when a finding has some immediate social relevance. Mussen and Conger handle these controversial areas extremely well. The evidence for each relationship they examine is comprehensively reviewed, the possible effects of omissions in experimental controls are considered, and the reader is assisted to form an evaluation of a rather large area of work. All of this can lead to some better understanding of child psychology and of the nature of scientific method as well.

Unlike many other writers in this field, Mussen and Conger have not avoided those difficult areas that lead the student to evaluate evidence concerning the practical problems of bringing up children. Data are presented on such worrisome problems as the consequences of birth injury, premature birth, methods of infant feeding, "good mothering," and the like. It is my impression that many people who are presently, or potentially, anxious about these problems would do well to read the dispassionate but interesting accounts given here of the present state of our knowledge about these matters.

The book discusses development through the first 2 years, the preschool years, "middle childhood," and adolescence. There is a section on adjustment to school and another on adjustment to peers in the middle period. The adolescent section includes material on physical development and on adolescent adjustment in American culture. These sections, like others throughout the book, provide fresh material and a fresh type of thinking about old problems. In part, this is a function of cultural anthropological influence, which has recently had much impact on thinking in child development. Contrasts with the progress of child development in other cultures are instructive in helping the reader to assume some degree of cultural relativity in evaluating the process of growing up in this country.

Excellently documented, the text contains complete chapter references plus a name and a subject index. Names of investigators are sparingly used in the text itself. With a common-sense and lucid approach to the material, a set toward the promotion of "reasoning-about" phenomena rather than a recital of facts, and a suitable regard for the facts themselves, this book should do much toward making a number of people both more knowledgeable about child development and happier in their acquisition of that knowledge.

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The American Arbacia and Other Sea Urchins. Ethel Browne Harvey. Princeton University Press, Princeton, N.J., 1956. 298 pp. Illus. + plates. $6.

As a rule, in the literature of experimental biology the hero is some principle or method or even the experimenter himself. It is refreshing, therefore, to have a book in which the victim of the experiments is the hero. So, here is *Arbacia*, the "material" of countless experiments, treated in its own right.

The first section is a highly entertaining historical sketch of sea urchins through the ages and their natural history. The next is on the egg, the sperm, and development, and the last is on centrifuged eggs—a field which the author has made distinctively her own. The following third of the book consists of tables of work alphabetically arranged under subject headings. The bibliography contains more than 1500 items. These include all important publications on *Arbacia punctulata* and many references to work on other echinoids, although some important ones are omitted. Before the text, not numbered, are 16 pages of plates from photographs showing steps in the development of *Arbacia*. Although the plan is useful, some of the figures are too faint to convey meaning.

On page 198 there is an echo of the classic battle of the giants, in the inference that T. H. Morgan was the first to discover a physicochemical method of parthenogenesis. However, the fact is that Morgan, in his papers cited, describes only cytasters and cell division resulting in heaps of cells which soon perished, never becoming embryos. He emphatically denied the possibility of obtaining embryos by physicochemical activation of the egg. Astounded at Loeb's success in rearing apparently normal morulae, blastulae, gastrulae, and

plutei by this method, Morgan asked Loeb how he knew the larvae had cilia. To this Loeb gave his fitting and famous reply: "Because I drove each cilium in with a hammer!"

The book is a masterpiece of thoroughness and organization and will be of great value to the beginner in research and to the veteran investigator. The typography by the G. J. Thieme Press of Nijmegen, the Netherlands, merits special note, and is a delight to the eye.

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New Books

Introduction to Solid State Physics. Charles Kittel. Wiley, New York; Chapman & Hall, London, ed. 2, 1956. 617 pp. $12.

A Practical Manual of Medical and Biological Staining Techniques. Edward Gurr. Interscience, New York, ed. 2, 1956. 451 pp. $6.50.

Work, Workers and Work Measurement. Adam Abruzzi. Columbia University Press, New York, 1956. 318 pp. $7.50.

Petrographic Modal Analysis. An elementary statistical appraisal. Felix Chayes. Wiley, New York; Chapman & Hall, London, 1956. 113 pp. $5.50.

Educating Spastic Children. The education and guidance of the cerebral palsied. F. Eleanor Schonell. Philosophical Library, New York, 1956. 242 pp. $6.

Essentials of Histology. Margaret M. Hoskins and Gerrit Bevelander. Mosby, St. Louis, ed. 3, 1956. 254 pp. $4.

Research in the Effects and Influences of the Nuclear Bomb Test Explosions. pts. I and II. Compiled by the Committee for Compilation of Report on Research in the Effects of Radioactivity. Japan Society for the Promotion of Science, Ueno, Tokyo, 1956 (order from Stechert-Hafner, New York 3). 1824 pp. $26.50.

Preparing for Motherhood. A manual for expectant parents. Samuel R. Meaker. Year Book, Chicago, 1956. 196 pp.

Discovery of the Elements. Mary E. Weeks. Henry M. Leicester, Ed. Journal of Chemical Education, Easton, Pa., ed. 6, 1956. 910 pp. $10.

Science and Economic Development: New Patterns of Living. Richard L. Meirer. Technology Press, Cambridge, Mass.; Wiley, New York; Chapman & Hall, London, 1956. 266 pp. $6.

Minado. A tale of the Quebec wilderness. Erle Wilson. Appleton-Century-Crofts, New York, 1956. 191 pp. $3.50.

The Future of Arid Lands. Papers and recommendations from the International Arid Lands Meeting. Publ. No. 43. Gilbert F. White, Ed. American Association for the Advancement of Science, Washington, 1956. $6.75; $5.75, members.

The Nature of Brucellosis. Wesley W. Spink. University of Minnesota Press, Minneapolis, 1956. 464 pp. $8.

The Scientific Thought of Henry Adams. Henry Wasser. The Author, University of Salonika, Greece, 1956. 127 pp.

Changes of State. A mathematical-physical assessment. H. N. V. Temperley. Cleaver-Hume, London; Interscience, New York, 1956. 324 pp. $7.50.

Methods of Chemical Analysis for Soil Survey Samples. Soil Bureau Bull. 12. A. J. Metson. New Zealand Department of Scientific and Industrial Research, Wellington, 1956. 208 pp. 30s.

Engineering Analysis. A survey of numerical procedures. Stephen H. Crandall. McGraw-Hill, New York, 1956. 416 pp. $9.50.

Technology and Engineering. Reactor coolants, moderators, heat transfer, reactor chemistry, and corrosion of reactor materials. R. Hurst and S. McLain, Eds. McGraw-Hill, New York; Pergamon Press, London, 1956. 420 pp. $12.

Philosophy of Science. pt. 1, *Science in General.* Duquesne Studies, Philosophical Ser. 6. P. Henry van Laer in collaboration with Henry J. Koren. Duquesne University, Pittsburgh 19, Pa.; Nauwelaerts, Louvain, Belgium, 1956. 164 pp. Cloth, $3.75; paper, $3.

Contributions to the Theory of Nonlinear Oscillations. vol. III. S. Lefschetz. Princeton University Press, Princeton, N.J., 1956. 285 pp. $4.

Disposal of Sewage and other Water-Borne Wastes. Karl Imhoff, W. J. Müller, D. K. B. Thistlethwayte. Based on a translation of Imhoff's *Taschenbuch der Stadtentwaesserung,* ed. 16, 1956. Butterworths, London, 1956. 347 pp. 45s.

Up-Hill All the Way, the Life of Maynard Shipley. Miriam Allen DeFord. Antioch Press, Yellow Springs, Ohio, 1956. 255 pp. $4.

General Relativity and Cosmology. vol. 4 of International Astrophysics Ser. G. C. McVittie. Wiley, New York, 1956. 198 pp. $9.

Dendroclimatic Changes in Semiarid America. Edmund Schulman. University of Arizona Press, Tucson, 1956. 142 pp. $3.

An Introduction to Matrix Tensor Methods in Theoretical and Applied Mechanics. Sidney F. Borg. Edwards, Ann Arbor, Mich., 1956. 202 pp. $4.75.

Concise Anatomy. Linden F. Edwards. McGraw-Hill, New York, ed. 2, 1956. 502 pp. $7.50.

Lectures on Rock Magnetism. Being the second Weizmann Memorial Lectures, December, 1954. P. M. S. Blackett. Weizmann Science Press of Israel, Jerusalem, 1956. 131 pp. $5.

Conference on Tissue Fine Structure. Arden House, Harriman, N.Y., 16–18 Jan. 1956. Keith R. Porter, Ed. *Journal of Biophysical and Biochemical Cytology,* vol. 2, No. 4, pt. 2, suppl. Rockefeller Institute for Medical Research, New York, 1956. 454 pp. $5.

Biochemical Techniques, a Laboratory Manual. F. M. Strong. Burgess, Minneapolis, Minn., 1956. 78 pp. $3.

The Rabbit in Experimental Physiology. Harold M. Kaplan. Scholar's Library, New York, 1956. 69 pp. $2.50.

Chemical Engineering Practice. vol. 1, *General.* Herbert W. Cremer, Ed. Academic Press, New York; Butterworths, London, 1956. 494 pp. $13.30 per volume on orders for complete set; $17.50.

Polymer Solutions. H. Tompa. Academic Press, New York; Butterworths, London, 1956. 325 pp. $8.50.

Rattlesnakes. Their habits, life histories, and influence on mankind. vols. 1 and 2. Laurence M. Klauber. University of California Press (for the Zoological Society of San Diego), Berkeley, 1956. 1476 pp. $17.50 per set.

Fundamentals of Immunology. William C. Boyd. Interscience, New York, ed. 3, 1956. 776 pp. $10.

The Earth We Live on. The story of geological discovery. Ruth Moore. Knopf, New York, 1956. 416 pp. $6.

Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, *but to the publisher or agency sponsoring the publication.)*

Annotated Bibliography of Geologic and Soils Literature of Western North Pacific Islands. Helen L. Foster. U.S. Army, Chief of Engineers, Washington 25, 1956. 884 pp.

The Plankton of the Beaufort and Chukchi Sea Areas of the Arctic and Its Relation to the Hydrography. Arctic Institute of North America Tech. Paper No. 1. Martin W. Johnson. Arctic Institute of North America, Montreal, Canada, 1956. 32 pp. $0.50.

Ruwenzori Expedition, 1934–35. Tipulidae. vol. 1, No. 7. Charles P. Alexander. British Museum (Natural History), London, 1956. 251 pp. £3.

Trends in the Employment and Training of Scientists and Engineers. Prepared for the National Committee for the Development of Scientists and Engineers. National Science Foundation, Washington, 1956 (order from Supt. of Documents, GPO, Washington 25). 23 pp. $0.20.

Crustacean Metamorphoses. Smithsonian Misc. Coll., vol. 131, No. 10. R. E. Snodgrass. Smithsonian Institution, Washington, 1956. 78 pp.

A Short Course in Radiological Protection. A.E.R.E. H.P./L. 23. Health Physics Division and Isotope School A.E.R.E. R. J. Sherwood and H. J. Dunster, Eds. Atomic Energy Research Establishment, Harwell, England, 1956. 100 pp. 3s. 3d.

Rapport Annuel sur le Fonctionnement Technique de l'Institut Pasteur de Saigon, 1955. Instituts Pasteur au Viet-Nam, Saigon, 1956. 114 pp.

Symposium on Rock Mechanics. Papers and discussion from the 1st annual Symposium on Rock Mechanics, Colorado School of Mines 23–25 Apr. 1956. Quarterly of the Colorado School of Mines, vol. 51, No. 3. Colorado School of Mines, Golden, 1956. 239 pp. $2.

Developments in the Accreditation of Teacher Education in the United States. National Catholic Education Association Special Study No. 1. George F. Donovan. National Catholic Educational Association, Washington 6, 1956. 66 pp. $1.25.

Landscape Evolution in the High Ituri Belgian Congo. Série Scientifique No. 66. Robert V. Ruhe. Institut National pour l'Étude Agronomique du Congo Belge, Brussels, 1956. 108 pp. F. 90.

Meetings and Societies

International Genetics

Two International Genetics Symposia on the subjects "Physical and chemical approaches to problems in chromosomes" and "Applied genetics," respectively, were held in Tokyo and Kyoto, Japan, 6–12 Sept. The symposia were organized by the Science Council of Japan as the second in a contemplated series of annual international scientific conferences. The two symposia were held jointly; their organization and attendance were such that in effect they constituted a small congress. Approximately 600 persons attended, including some 500 Japanese biologists and about 100 foreign delegates from the following countries: Belgium, Canada, China (Formosa), Denmark, France, Germany, Great Britain, India, Indonesia, Israel, Italy, Korea, Malaya and Singapore, the Netherlands, the Philippines, Portugal, Sweden, U.S.A., U.S.S.R., and Yugoslavia. Attendance of the large United States delegation was made possible by 40 travel grants from the National Science Foundation and the Office of Naval Research.

Plenary sessions of the symposia were held in the mornings and special sessions in the afternoons. Nearly 150 papers, all in English, and touching on every aspect of modern genetics, were presented. All sessions except the last were held in Tokyo. For the final session, the entire conference moved to Kyoto, ancient capital of Japan and, culturally, surely one of the world's most interesting cities. The quality of the papers was high. No attempt to summarize them will be made here, however, since the proceedings of the meeting will be published shortly.

Particular interest is attached to the new Soviet position with respect to Western genetics. These symposia were the first international genetics meetings to be attended by a Soviet delegation since the launching of the official attack on Mendelism in the late 1930's. The Soviet delegation consisted of I. E. Glushchenko, H. F. Kushner, and K. S. Sukhov from the Institute of Genetics and A. A. Imshenezkii from the Institute of Microbiology of the U.S.S.R. Academy of Sciences, Moscow. They were accompanied by an interpreter.

The present Soviet position, insofar as it can be stated, appears to consist of acceptance of the facts of Mendelian genetics, coupled with denial of their exceptional importance. The Soviet delegates employed Mendelian terminology in their papers, speaking of dominant and recessive traits and of mendelizing characters. I was told by Kushner, who spoke English: "We accept facts, and the 3/1 ratio is an undeniable fact. I teach my students that heredity is complicated, with several different forms: Mendelian, nuclear heredity; non-Mendelian, cytoplasmic heredity; and the kind of heredity I find in my experiments with blood transfusions." The experiments referred to purport to show that transfusion of blood from one breed of chickens to another, or even between different species of birds, can cause the offspring of the recipient to resemble the donor in plumage and other traits and that these changes are inherited.

Although the basic Soviet preoccupation is still Lysenkoist, a conciliatory attitude toward Mendelian genetics was quite evident at this meeting. This desire to conciliate may be sufficiently strong to allow genetics to gain a foothold again in the U.S.S.R. Indeed, we were told that Dubinin is now working on *Drosophila* in a radiobiological institute in Moscow. Of even greater immediate importance than the revival of genetics research would be a renaissance of genetics teaching in Soviet schools and universities. As yet, however, there is no clear sign that teaching has been profoundly modified.

Of the many memorable events of this meeting, special mention must be made of the exhibitions of plants and animals of particular genetic interest in Japan. These included silkworms, goldfish, long-tailed fowl, rice, wheat, Japanese morning-glory, and radishes. The breeding of most of these species is an ancient and in some cases peculiarly Japanese art, dating back at least 1000 years, for example, in the case of the silkworm, radish, and morning-glory. Most of the exhibits were living, and no pains were spared to insure that they were in prime condition and appropriately displayed.

For most of the foreign delegates, this was their first encounter with much of this material. Many were surprised to learn that in the Japanese morning-glory, *Pharbitis nil* ($n = 15$), exhibited at the National Institute of Genetics, Misima, no less than 219 genes and 10 linkage groups are known. In the silkworm, *Bombyx mori* ($n = 28$), 211 genes and 15 linkage groups are known. In contrast to *Drosophila*, the majority of known mutations of *Bombyx* are expressed in the egg, larva, and cocoon. A variety of these were handsomely displayed at the Sericultural Experiment Station, Tokyo.

Much interest was shown in the method for sexing silkworms in the egg stage. This is made possible by a translocation to the W (female-determining) chromosome of a fragment carrying a dominant color gene. A new photoelectric gadget that scans a sample of eggs and neatly electrocutes the females was demonstrated. The process is of potential economic interest, because males produce more silk than females.

The collections of rice at the National Institute of Agricultural Sciences, Hiratuka Branch, and of wheat and goldfish, displayed at the Municipal Art Gallery of Kyoto, were very fine. As for the long-tailed fowl displayed at the Ueno Zoological Garden, Tokyo, and the giant radishes, many persons seemed to arrive at the same conclusion as the Soviet delegate who exclaimed "Impossible!" when he saw a living giraffe for the first time at the Osaka Zoo.

In addition to the afore-mentioned displays, there was an interesting exhibition of old documents and wood-block prints of genetic or agricultural interest, at the University of Tokyo. Finally, mention must be made of the seedless watermelon, the theory and practice of which were demonstrated at the Kihara Institute in Yokohama. The plant is a triploid and produces only small, aborted seeds; the flavor is delicious.

Besides the scheduled scientific sessions and exhibitions, opportunities were provided for visits to university laboratories and research institutes. It was a pleasure to meet many Japanese colleagues who had previously been known only through correspondence. Most impressive was the enthusiasm for genetical research among Japanese biologists. This can be gaged by the fact that the membership of the Genetics Society of Japan equals in number that of the Genetics Society of America.

Thanks to the generous hospitality of our hosts, many opportunities were also provided for sampling various aspects of Japanese life. These included visits to national cultural monuments, such as those of Nara and Nikko, to the Kabuki Theater, and to Japanese homes, restaurants, and teahouses.

The International Genetics Symposia were altogether a memorable affair. It was pointed out in one of the welcoming addresses at the opening session that this

was the first genetics conference of such scope ever held in Asia. The unanimous wish of the foreign delegates was that it will not be the last.

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Preview of Programs at AAAS New York Meeting

Some of the programs to be presented at the 1956 AAAS meeting in New York are given here. Others will be announced from time to time in subsequent issues.

AAAS Special Sessions

One of the characteristic and most important features of the annual meetings of the AAAS is the series of outstanding general addresses by distinguished experts, sponsored by organizations that meet regularly with the association. These special events are joint sessions with the AAAS and are open to the general public of the city in which the meeting is held.

Society of the Sigma Xi and Scientific Research Society of America. Joint annual address, 27 Dec., 8 P.M. "Technology and society," by Lawrence R. Hafstad, vice president and director of research, General Motors Corporation. Joseph W. Barker, president, Research Corporation, and president of the Society of the Sigma Xi, will preside. Wallace R. Brode, associate director, National Bureau of Standards, and chairman of the Scientific Research Society of America, will award the William Procter prize. George W. Beadle, retiring president of AAAS, will represent the association.

United Chapters of Phi Beta Kappa. Annual address, 27 Dec., 8 P.M. "Toward more vivid utopias," by Margaret Mead, associate curator of ethnology, American Museum of Natural History. Kirtley F. Mather, emeritus professor of geology, Harvard University, and member of the senate of the United Chapters of Phi Beta Kappa, will preside. Laurence H. Snyder, president-elect of AAAS, will represent the AAAS.

AAAS presidential address. 28 Dec., 8 P.M. "The uniqueness of man," by George W. Beadle, chairman, division of biology, California Institute of Technology, and retiring president of the association. Paul B. Sears, director, Conservation Program, Yale University, and president of the association, will preside. Preceding the address, Eugene Holman, chairman of the board, Standard Oil Company (N.J.), and general chairman of the New York meeting, will speak briefly. Following the address there will be an informal reception in the ballroom and adjacent rooms of the Hotel Statler. All registrants and members of the local committees are cordially invited to attend.

National Geographic Society. Annual lecture and film, 29 Dec., 7 P.M. "Southeast Asia's golden pageantry," by W. Robert Moore, chief, foreign editorial staff, National Geographic Society. Paul B. Sears, president, AAAS, will preside.

"Science Sunday" service and mass. St. Patrick's Cathedral, 30 Dec., 10 A.M. Rev. Laurence J. McGinley, S.J., president, Fordham University. Cardinal Spellman will preside. Hugh S. Taylor will represent the association. A portion of the cathedral will be set apart for visiting scientists.

Details of the two sessions of the AAAS general symposium, "Fundamental units and concepts of science" were given in last week's issue, and the 25th anniversary program of the Gordon Research Conferences will be announced in a subsequent issue.

AAAS Conferences

In recent years, in addition to the Academy Conference, several conferences have become recurrent events at AAAS meetings. Also interest in special subjects may develop to the point where a special program is arranged. These conferences and special programs are open to all who are interested.

Academy Conference, 29 Dec., morning and afternoon.

Conference on Scientific Editorial Problems, 26–28 Dec., six sessions.

Conference on Scientific Manpower, 26 Dec., afternoon. Paul B. Sears will preside. "The program of the national committee for the development of scientists and engineers," by Howard L. Bevis, chairman, National Committee for the Development of Science and Engineering, Washington, D.C. Implications for the physical sciences, for engineering, and for the life sciences will be discussed, respectively, by J. C. Warner, president, Carnegie Institute of Technology; Earl P. Stevenson, chairman of the board, Arthur D. Little, Inc.; and Milton O. Lee, executive secretary, Federation of American Societies for Experimental Biology.

Meeting Notes

■ The sixth annual symposium on blood will be held at Wayne State University, 18–19 Jan. 1957. Papers will be presented throughout the first day in the auditorium of the College of Medicine. Facilities for a group dinner and social gathering are being reserved for that evening. The scientific program will be concluded at noon on the 19th. Ample time is being allowed for the audience to discuss the contributions of the invited speakers. For information, write to Walter H. Seegers, Department of Physiology and Pharmacology, Wayne State University, Detroit 7, Mich.

■ The Institute of International Education has announced that the second National Conference on Exchange of Persons, on the theme "Education for international responsibilities," will take place at the Congress Hotel, Chicago, Ill., 5–7 Dec.

■ Some 7000 engineers are expected to attend the annual meeting of the American Society of Mechanical Engineers that will be held in New York, 25–30 Nov. More than 300 technical papers will be presented and discussed in a program whose theme is "Free exchange of knowledge—path to the future." Meeting sessions will be held in two midtown hotels, the Statler and the Sheraton-McAlpin.

Special features of the program include a 3-day International Conference on the Fatigue of Metals, which will make available to American audiences for the first time information presented originally at a similar conference in London in September. In order to compress the scheduled 72 technical papers into 3 days, the usual procedure under which each author summarizes his paper will be dispensed with. Instead, presentation will be mechanized, with a "reporter" summarizing all papers briefly—as many as 15 in a single session—thus leaving maximum time for discussion.

Joseph W. Barker will deliver his final address as society president at the president's luncheon on 26 Nov. The featured speaker at the ASME annual banquet on 28 Nov. will be Donald A. Quarles, Secretary of the Air Force.

■ Recently the National Conference on the Evaluation of Pharmacotherapy in Mental Illness met in Washington, D.C., under the sponsorship of the American Psychiatric Association, the National Academy of Sciences–National Research Council (Division of Medical Sciences), and the National Institute of Mental Health. R. W. Gerard, University Hospital, Ann Arbor, Mich., was conference chairman, and J. O. Cole was executive secretary of the conference. Cole is psychiatrist in charge for the projected Psychopharmacology Service Center of the National Institute of Mental Health, for which Congress has appropriated $2 million to coordinate drug evaluation.

The conference formulated the following recommendations for the new center: (i) that support be provided basic research, launching of pilot studies, development of a methodology, and coordination of cooperative programs; (ii) that increased attention be given to the effects

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CURRENTS, FIELDS, AND PARTICLES

By Francis Bitter, *The Massachusetts Institute of Technology.* Describes—in a novel and refreshing manner—macroscopic electromagnetic phenomena in terms of fields and microscopic atomic phenomena in terms of quanta. Offers a solid introduction to certain abstract concepts, among them energy, momentum, electric and magnetic fields, conservation laws, impedance, reactance, etc. The author has attempted to illustrate the importance of quantitative thinking, and, although a great deal of factual material is included, the emphasis is on analysis. Co-published by The Technology Press, M.I.T. *1956. 599 pages. $8.50.*

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of drugs on behavioral and psychological functioning; (iii) that the center arrange a conference to discuss the preclinical data available on new drugs and the information desired by the clinicians studying them; (iv) that the center seek to improve channels of communication in this and related fields by the preparation of annotated bibliographies, reviews, news letters, and appropriate conferences.

■ The first annual training institute of the American Group Psychotherapy Association will be held on 9 Jan. 1957 at the Henry Hudson Hotel, New York. From 10–12 Jan. the association's 14th annual conference will follow at the same location. For further information, write to: AGPA, Room 300, 345 E. 46 Street, New York 17, N.Y. Advance registration will close *on 20 Dec.*

■ Formation of the Venezuelan Geophysical Association (Associacion Venezolona Geofisica) has been announced in Caracas by C. G. Schauble, chief seismologist for the Sinclair Oil and Gas company and acting secretary of the association. Other temporary officers of the new organization are Clifford A. Wachter, chief geophysicist for the Venezuelan Atlantic Refining Company, acting legal representative, and Joseph A. Keeling, geophysical supervisor for Phillips Petroleum Company, program chairman. All are members of the Society of Exploration Geophysicists, and according to Schauble the 51 charter members hope to become a local section of SEG as soon as the bylaws have been registered in accordance with Venezuelan law.

Simultaneously it was announced at SEG headquarters in Tulsa, Okla., that three other sections are being formed. Geophysicists in the Salt Lake City area have organized under the leadership of T. E. Hobbs, division geophysicist for the General Petroleum Corporation; G. D. Garland of the University of Alberta is chairman of the organizing committee for a section in Edmonton, Alberta, Canada; and James A. Hafes, geophysicist for British American Petroleum Company, heads the committee to organize a group in Regina, Saskatchewan. The affiliations of these new sections will bring the number of SEG local sections to 20.

■ The first International Conference on Operations Research will be held in Oxford, England 2–6 Sept. 1957, under the sponsorship of the Operational Research Society of Great Britain, the Operations Research Society of America, and the Institute of Management Sciences. Delegations are being organized by local societies in France, Germany, Italy, Norway, and Japan, and the interest in this rapidly developing new science is expected to bring observers from several other countries also.

Papers on operations research or its applications are now being selected for the agenda, later to be published in full as a single volume of transactions. Summaries of about 200 words in length should be sent to Thornton Page, Operations Research Office, 7100 Connecticut Ave., Chevy Chase 15, Md.

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■ American Society for Horticultural Science: pres., L. D. Davis, University of California, Davis; v. pres., W. T. Pentzer, U.S. Department of Agriculture, Beltsville, Md.; sec.-treas., Freeman S. Howlett, Ohio Agriculture Experiment Station, Wooster, Ohio.

■ American Society of Zoologists: pres., Elmer Butler; pres.-elect, H. Burr Steinbach; past pres., Tracy Sonneborn; sec., Rudolf T. Kempton; treas., Jane Oppenheimer.

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PHYSIOLOGY — Vol. 18 (Mar. 1956)
PHYSICAL CHEMISTRY — Vol. 7 (Sept. 1956)

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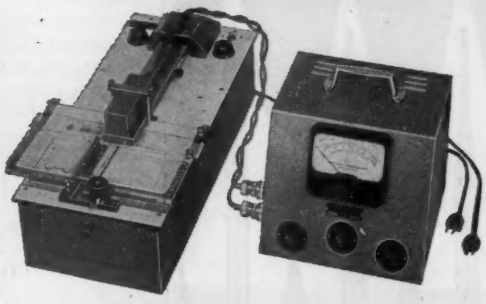

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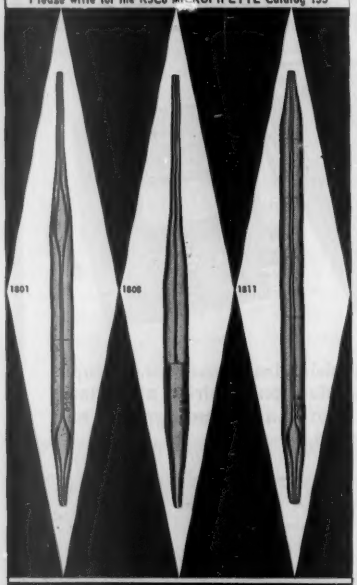

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■ American Institute of Biological Sciences: pres., Wallace O. Fenn, University of Rochester School of Medicine; v. pres., Paul Kramer, Duke University; sec.-treas., Frank P. Cullinan, Bureau of Plant Industry, Beltsville, Md.

Forthcoming Events

December

13–15. Texas Acad. of Science, annual, Brownwood, Tex. (G. C. Parker, Texas A.&M. College, College Station.)

19. Arctic Branch, Alaska Div., AAAS, College Alaska. (Miss C. Juedes, Box 47, College.)

26–31. American Assoc. for the Advancement of Science, annual, New York, N.Y. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington 5.)

The following 56 meetings are being held in conjunction with the AAAS annual meeting.

AAAS Academy Conference (L. Taylor, West Virginia Univ., Morgantown). 29–30 Dec.

AAAS Cooperative Committee on the Teaching of Science and Mathematics (M. Meister, Bronx High School of Science, New York 68). 27 Dec.

AAAS-Gordon Research Conferences (W. G. Parks, Univ. of Rhode Island, Kingston). 27 Dec.

Alpha Chi Sigma (H. G. Seavey, 30 Church St., Room 340, New York 7). 28 Dec.

Alpha Epsilon Delta (M. L. Moore, 7 Brookside Circle, Bronxville, N.Y.). 29 Dec.

American Assoc. of Clinical Chemists (A. E. Sobel, Jewish Hospital of Brooklyn, Brooklyn 16, N.Y.).

American Assoc. of Hospital Consultants (E. D. Barnett, School of Public Health, Columbia Univ., New York 32.)

American Assoc. of Scientific Workers (R. J. Rutman, 6331 Ross St., Philadelphia 44, Pa.). 29 Dec.

American Astronomical Soc. (J. A. Hynek, Harvard College Observatory, Cambridge 38, Mass.). 26–29 Dec.

American Documentation Inst. (J. Hilsenrath, National Bureau of Standards, Washington 25). 27–29 Dec.

American Educational Research Assoc. (A. G. Wesman, Psychological Corp., 522 Fifth Ave., New York 36). 29 Dec.

American Meteorological Soc. (R. J. Roth, Crop-Hail Insurance Actuarial Assoc., 209 W. Jackson Blvd., Chicago, Ill.). 28 Dec.

American Museum of Natural History (G. Reekie, AMNH, Central Park West at 79 St., New York, N.Y.). 26 Dec.

American Nature Study Soc. (R. L.

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Weaver, Univ. of Michigan, Ann Arbor). 26–30 Dec.

American Philosophical Assoc., Eastern Div. (J. Wild, Harvard Univ., Cambridge 38, Mass.). 27 Dec.

American Psychiatric Assoc. (B. Pasamanick, Ohio State Univ., Columbus 10). 28–29 Dec.

American Soc. of Hospital Pharmacists (G. E. Archambault, U.S. Public Health Service, Washington 25). 29 Dec.

American Soc. of Range Management (F. G. Renner, Soil Conservation Service, U.S. Dept. of Agriculture, Washington 25). 28 Dec.

American Statistical Assoc. (R. E. Johnson, Western Electric Co., New York 7).

Association for Computing Machinery (J. P. Nash, Univ. of Illinois, Urbana).

Association of American Geographers (P. M. Stern, Conservation Foundation. 30 E. 40 St., New York, N.Y.).

Astronomical League (H. B. Davidson. 812 Park Ave., New York 21.)

Conference on Scientific Editorial Problems (J. G. Adashko, Ford Instrument Co., Long Island City, N.Y.). 26–28 Dec.

Conference on Scientific Manpower (T J. Mills, National Science Foundation, Washington 25). 26 Dec.

Ecological Soc. of America (M. F. Buell, Rutgers Univ., New Brunswick. N.J.). 26–30 Dec.

Entomological Soc. of America (P. W. Oman, Plant Industry Sta., Beltsville, Md.). 27–30 Dec.

Genetics Soc. of America (A. W. Pollister, Columbia Univ., New York 27). 28 Dec.

History of Science Soc. (Miss P. Kibre, Hunter College, New York, N.Y.). 27–29 Dec.

Honor Soc. of Phi Kappa Phi (L. R. Guild, 634 So. Western Ave., Los Angeles 5, Calif.). 28–29 Dec.

Institute of Mathematical Statistics (Miss E. Scott, Univ. of California, Berkeley 4).

International Council for Exceptional Children (M. H. Fouracre, Columbia Univ., New York 27). 26 Dec.

International Union for the Study of Social Insects, North American Section (T. C. Schneirla, American Museum of Natural History, Central Park West at 79 St., New York, N.Y.). 26–27 Dec.

Mountain Lake Biological Sta. (B. D. Reynolds, Univ. of Virginia, Charlottesville).

Mycological Soc. of America (L. S. Olive, Columbia Univ., New York 27). 26 Dec.

National Acad. of Economics and Political Science (D. P. Ray, George Washington Univ., Washington, D.C.). 27 Dec.

National Assoc. for Gifted Children (Miss A. F. Isaacs, 409 Clinton Springs Ave., Cincinnati, Ohio).

National Assoc. for Research in Science Teaching (N. Washton, Queens College, Flushing 67, L.I., N.Y.). 27 Dec.

National Assoc. of Biology Teachers (J Breukelman, State Teachers College, Emporia, Kan.). 26–30 Dec.

National Assoc. of Science Writers (J E. Pfeiffer, New Hope, Pa.).

National Geographic Soc. (W. R. Gray. NGS, 16 and M Sts., NW, Washington 6). 29 Dec.

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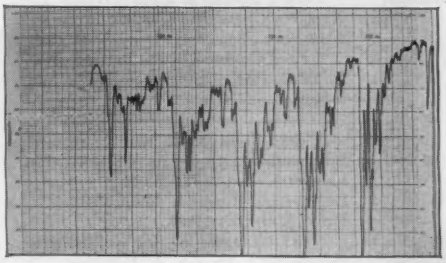

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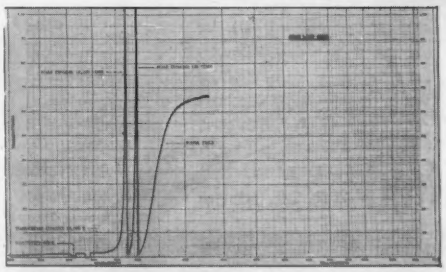

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Philosophy of Science Assoc. (C. W. Churchman, Case Inst. of Technology, Cleveland, Ohio). 29–30 Dec.

Pi Gamma Mu (B. H. Williams, Industrial College of the Armed Forces, Washington 25). 26 Dec.

Scientific Research Soc. of America (D. B. Prentice, Yale Univ., New Haven, Conn.). 26–27 Dec.

Sigma Delta Epsilon (C. Chandler, Boyce Thompson Inst. for Plant Research, 1086 N. Broadway, Yonkers 3, N.Y.).

Sigma Pi Sigma (M. W. White, Pennsylvania State Univ., University Park).

Society for the Advancement of Criminology (D. E. J. MacNamara, New York Inst. of Criminology, 2109 Broadway, New York, N.Y.). 29 Dec.

Society for the Advancement of General Systems Theory (L. von Bertalanffy, Mt. Sinai Hospital, Los Angeles 48, Calif.). 29–30 Dec.

Society for the Study of Evolution (H. Lewis, Univ. of California, Los Angeles 24). 27–29 Dec.

Society of General Physiologists (A. Shanes, National Institutes of Health, Bethesda, Md.).

Society of Systematic Zoology (R. E. Blackwelder, Box 500, Victor, N.Y.). 27–30 Dec.

Society of the Sigma Xi (T. T. Holme, Yale Univ., New Haven, Conn.). 27 Dec.

Society of Vertebrate Paleontology, annual (J. T. Gregory, Peabody Museum of Natural History, Yale Univ., New Haven, Conn.). 28–30 Dec.

Torrey Botanical Club (David Keck, New York Botanical Garden, Bronx Park, New York 58). 26–27 Dec.

United Chapters of Phi Beta Kappa (C. Billman, PBK, 1811 Q St., NW, Washington 6). 27 Dec.

27–28. Fluid Mechanics in Chemical Engineering, American Chemical Soc., Lafayette, Ind. (W. E. Ranz, Dept. of Engineering Research, Pennsylvania State Univ., University Park.)

27–28. Linguistic Soc. of America, Philadelphia, Pa. (A. A. Hill, Box 7790, University Sta., Austin 12, Tex.)

27–29. American Mathematical Soc., 63rd annual, Rochester, N.Y. (J. H. Curtiss, AMS, 80 Waterman St., Providence 6, R.I.)

27–29. American Physical Soc., Monterey, Calif. (W. A. Nierenberg, Univ. of California, Berkeley 4.)

27–29. Western Soc. of Naturalists, annual, Goleta, Calif. (D. Davenport, Santa Barbara College, Goleta.)

27–30. American Economic Assoc., annual, Cleveland, Ohio. (J. W. Bell, 629 Noyes St., Evanston, Ill.)

27–30. American Finance Assoc., annual, Cleveland, Ohio. (G. E. Hassett, Jr., New York Univ., 90 Trinity Place, New York 6.)

28. Society for the Advancement of Criminology, annual western, Fresno, Calif. (W. Dienstein, Fresno State College, Fresno.)

28–29. American Folk-Lore Soc., annual, Santa Monica, Calif. (MacE. Leach, Bennett Hall, Univ. of Pennsylvania, Philadelphia 4.)

28–30. American Anthropological Assoc., annual, Santa Monica, Calif. (W. S. Godfrey, Jr., Logan Museum, Beloit College, Beloit, Wis.)

28–30. American Historical Assoc., annual, St. Louis, Mo. (AHA, Study Room 274, Library of Congress, Washington 25.)

28–30. Archaeological Inst. of America, annual, Philadelphia, Pa. (C. Boulter, Library, Univ. of Cincinnati, Cincinnati 21, Ohio.)

28–30. Industrial Relations Research Assoc., Cleveland, Ohio. (E. Young, Sterling Hall, Univ. of Wisconsin, Madison 6.)

29. Mathematical Assoc. of America, 40th annual, Rochester, N.Y. (H. M. Gehman, Univ. of Buffalo, Buffalo 14, N.Y.)

29–30. American Chemical Soc., Div. of Industrial and Engineering Chemistry, Princeton, N.J. (A. H. Emery, ACS, 1155 16 St., NW, Washington 6, D.C.)

January

7–11. International Social Science Council, 3rd gen'l. assembly, Paris, France. (Secretary Gen'l., ISSC, 19, avenue Kleber, Paris 16.)

10. Technical and Clinical Applications of Radioisotopes, Assoc. of Vitamin Chemists, Chicago, Ill. (M. Freed, Dawe's Laboratories, Inc., 4800 S. Richmond St., Chicago 32.)

10–12. American Group Psychotherapy Assoc., 14th annual, New York, N.Y. (C. Beukenkamp, Jr., AGPA, Room 300, 345 E. 46 St., New York 17.)

14–16. Cottonseed Processing as Related to the Nutritive Value of the Meal, 4th conf., New Orleans, La. (Southern Regional Research Lab., USDA, 1100 Robert E. Lee Blvd., New Orleans 19.)

14–16. Reliability and Quality Control in Electronics, 3rd natl. symp., Washington, D.C. (C. M. Ryerson, Radio Corp. of America, Bldg. 10–6, Camden 2, N.J.)

14–18. Society of Automotive Engineers, annual, Detroit, Mich. (Meetings Div., SAE, 29 W. 39 St., New York 18.)

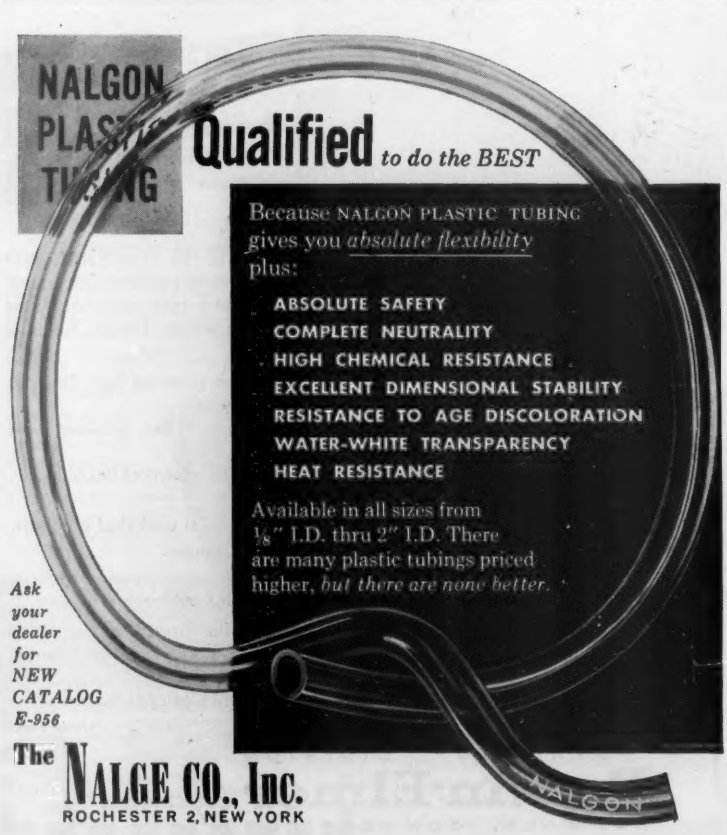
14–20. Indian Science Cong. Assoc., 44th meeting, Calcutta, India. (General Secretary, ISCA, 1 Park St., Calcutta 16.)

16–23. Australian and New Zealand Assoc. for the Advancement of Science, 32nd meeting, Dunedin, N.Z. (J. R. A. McMillan, ANZAAS, Science House, 157 Gloucester St., Sydney, N.S.W., Australia.)

17–18. Engineers Joint Council, New York, N.Y. (EJC, 29 W. 39 St., New York 18.)

18–19. Symposium on Blood, 6th annual, Detroit, Mich. (W. H. Seegers, Wayne State Univ. Coll. of Medicine, Detroit 7.)

21–22. Solar Furnace Design and Op-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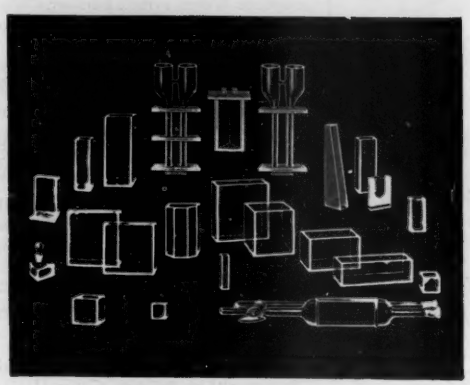

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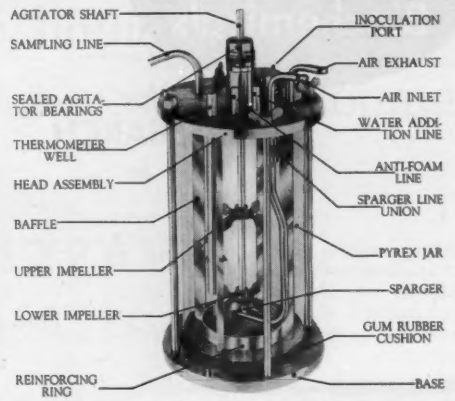

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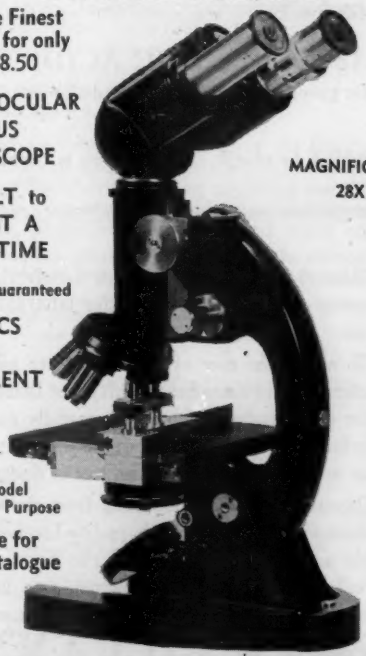

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eration, Phoenix, Ariz. (J. I. Yellott, Assoc. for Applied Solar Energy, 3424 N. Central Ave., Phoenix.)

21–25. American Inst. of Electrical Engineers, winter general, New York, N.Y. (N. S. Hibshman, AIEE, 39 W. 39 St., New York 18.)

23–25. Very Low Frequency Electromagnetic Waves, symp., Boulder, Colo. (J. R. Wait, National Bureau of Standards, Boulder.)

28–29. Many Body Problem, symp., Hoboken, N.J. (G. J. Yevick, Dept. of Physics, Stevens Inst. of Technology, Hoboken.)

28–31. American Meteorological Soc., New York, N.Y. (K. C. Spengler, AMS, 3 Joy St., Boston 8, Mass.)

28–31. Modern Methods of Analytical Chemistry, 10th annual symp., Baton Rouge, La. (P. W. West, Louisiana State University, Baton Rouge.)

30–1. American Assoc. of Physics Teachers, New York, N.Y. (F. Verbrugge, Carleton College, Northfield, Minn.)

30–31. College-Industry Conf., 9th annual, American Soc. for Engineering Education, Los Angeles, Calif. (Univ. of California Extension, Engineering, Los Angeles 24.)

31–2. Western Soc. for Clinical Research, 10th annual, Carmel-by-the-Sea, Calif. (A. J. Seaman, WSCR, Univ. of Oregon Medical School, Portland 1.)

February

4–8. American Soc. for Testing Materials, Philadelphia, Pa. (R. J. Painter, ASTM, 1916 Race St., Philadelphia 3.)

10–12. Canadian Ceramic Soc., 55th annual, Niagara Falls, Ont., Canada. (L. C. Keith, 49 Turner Rd., Toronto, Ont.)

14. Present Status of Heart Sound Production and Recording, symp., Buffalo, N.Y. (R. M. Kohn, Univ. of Buffalo, 2183 Main Street, Buffalo 14, N.Y.)

14. Significance of Nucleic Acid Derivatives in Nutrition, Assoc. of Vitamin Chemists, Chicago, Ill. (M. Freed, Dawe's Laboratories, Inc., 4800 S. Richmond St., Chicago 32.)

14–15. Transistor Circuits, conf., Philadelphia, Pa. (G. H. Royer, Westinghouse Electric Corp., 356 Collins Ave., Pittsburgh 6, Pa.)

15–16. National Soc. of Professional Engineers, Charleston, S.C. (P. H. Robbins, 2029 K St., NW, Washington 6.)

18–20. American Educational Research Assoc., annual, Atlantic City, N. J. (F. W. Hubbard, AERA, 1201 16 St., NW, Washington 6.)

18–22. American Soc. of Civil Engineers, Jackson, Miss. (W. H. Wisely, ASCE, 33 W. 39 St., New York 18.)

18–22. Endocrinology: Hormones in Blood, Ciba Found. Colloq. (by invitation), London, England. (G. E. W. Wolstenholme, 41 Portland Place, London, W.1.)

23. Oregon Acad. of Science, annual, Monmouth, (F. A. Gilfillan, Oregon State College, Corvallis.)

24–28. American Inst. of Mining, Metallurgical and Petroleum Engineers, annual, New Orleans, La. (E. O. Kirkendall, AIME, 29 W. 39 St., New York 18.)

EQUIPMENT NEWS

All inquiries concerning items listed here should be addressed to Science, *Room 604, 11 W. 42 St., New York 36, N.Y. Include the name(s) of the manufacturer(s) and the department number(s).*

■ STEPWISE SCANNING SPECTROMETER SYSTEM has been announced by Tracerlab. The system is an automatic-stepping, single-channel, pulse-height analyzer. It is designed to assay radioactive samples quantitatively and to perform isotopic separation by the analysis of nuclear radiation spectra. It consists of a radiation spectrometry detector and a data printer. (Tracerlab, Inc., Dept. S66)

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■ SELF-BALANCING, RECORDING POTENTIOMETERS for use with analog-to-digital conversion devices are designed to give full-scale traverse in 0.4 sec. Ample torque is available for operating retransmitting slidewires, alarm contacts, and other auxiliary devices. Round-chart models are available for use where prominent indication of the variables is needed. Various pen speeds can be supplied. (Bristol Co., Dept. S70)

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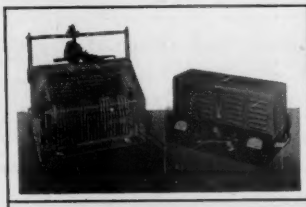

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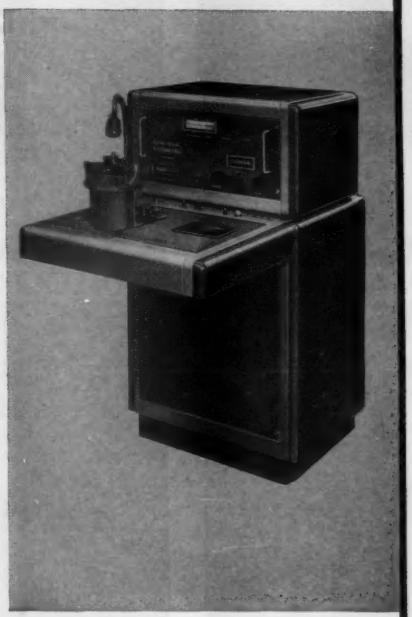

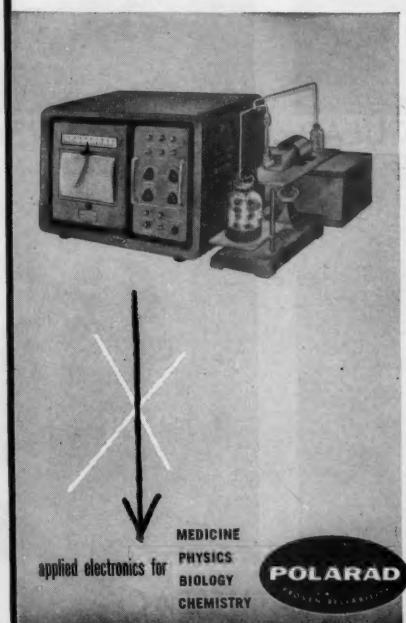

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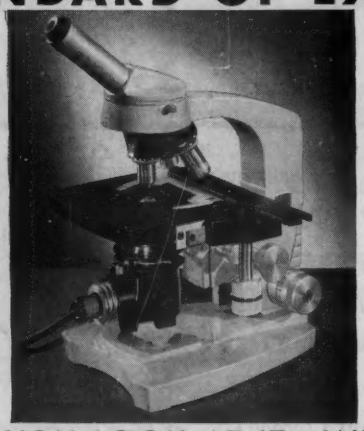
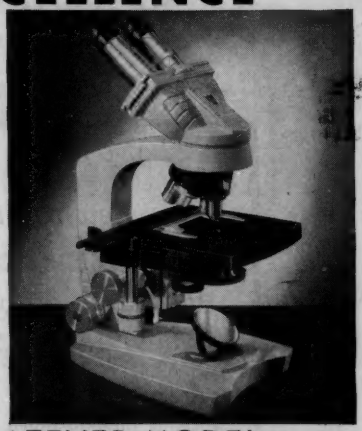
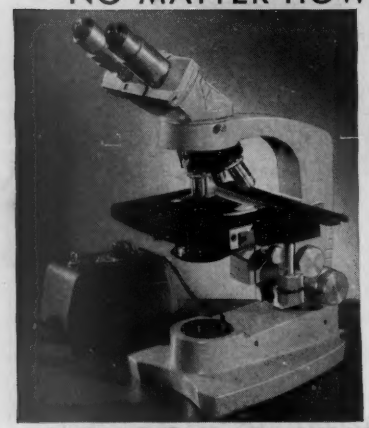
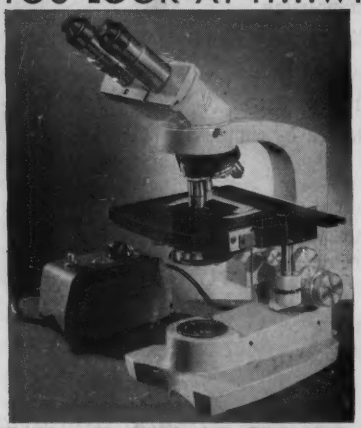
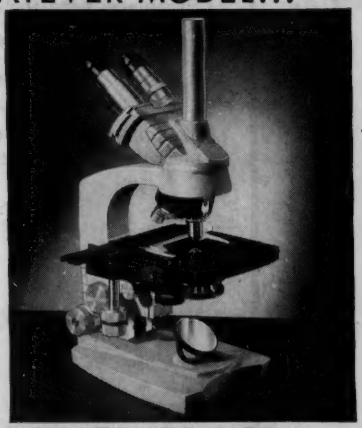
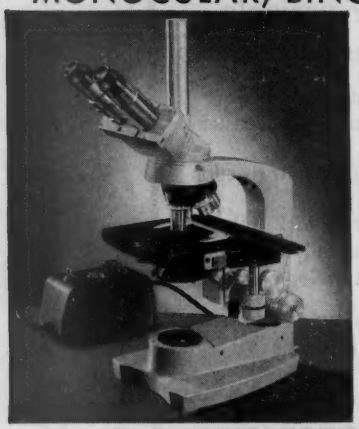
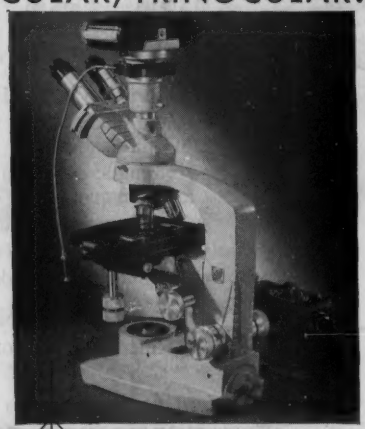
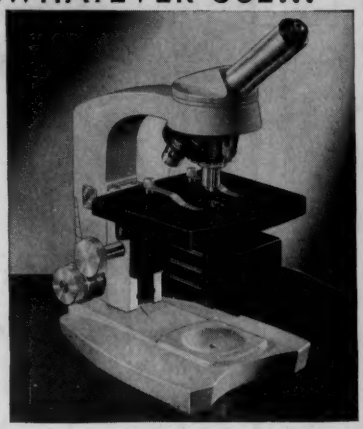



NO MATTER HOW YOU LOOK AT IT...WHATEVER MODEL...

MONOCULAR, BINOCULAR, TRINOCULAR...WHATEVER USE...

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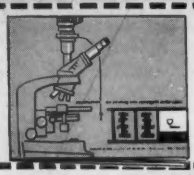

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